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AUTHOR	Arneson, R.: And Others
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ABSTRACT

One of three individualized courses included in a plumbing curriculum, this course covers installing, servicing, and repairing supply lines and fixtures commonly found in residential/commercial structures. The course is comprised of four units: (1) Pipe and Fittings, (2) Cold Water Supply, (3) Hot Water Supply, and (4) Fixtures. Each unit begins with a Unit Learning Experience Guide that gives directions for unit completion. The remainder of each unit consists of Learning Activity Packages (LAP) that provide specific information for completion of a learning activity. Each LAP is comprised of the following parts: objective, evaluation procedure, resources, procedure, supplemental sheets, study guide, and a LAP test with answers. The course is preceded by a pretest which is designed to direct the student to units and performance activities. (LRA)

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MOUNTAIN PLAINS LEARNING EXPERIENCE GUIDE:

Plumbing.

Course: Supply Piping Systems.

CE 027 815

U.S. DEPARTMENT OF HEALTH,
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Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Learning Experience Guide

COURSE: SUPPLY PIPING SYSTEMS

DESCRIPTION:

This course is about plumbing finish installations. The finish applications include installing, servicing and repairing supply lines and fixtures commonly found in residential/commercial structures.

Installation activities include designing, planning, assembling and installing supply piping systems and fixtures. The design portion includes activities like: pipe size determination, friction loss, British Thermal Unit calculation and fixture type and size. Assembly and installation activities include pipe and fitting identification and function. The processes of soldering, flaring, cutting, measuring and fastening are an integral portion of assembly and installation.

Fixture design, installation, service and repair are emphasized in one of the units in this course. Size, type and layout determination is emphasized in the design portion of the unit. Design also includes the identification of various requirements such as plumbing codes, customer specifications and manufacturer's specification. Water conditioning is also included in designing supply systems. The fixture installation service and repair portion includes such fixtures as sinks, bath/shower, water closet, heaters, softeners and garbage disposals. These are all installed by the student to various given specifications. In this area, as in all areas, neatness and accuracy are requirements. Safe practices and procedures established in the plumbing industry are presented.

Service activities for the supply piping systems and fixtures include the removal of obstructions and adjustments and calibrations required for plumbing systems to function properly.

Repair operations for supply systems and fixtures include the removal, modification or replacement of portions of residential/commercial plumbing systems.

RATIONALE:

Mastery of these course activities will provide the student with the entry-level skills for finish installation, service and repair tasks that are commonly assigned to plumbers.

PREREQUISITES:

Course: Drainage and Vent Systems

Principal Author(s):

R. Arneson, T. Bundy, T. Frisbee

OBJECTIVES:

Plan, prepare and assemble the finish portions of plumbing systems according to given specifications (codes, manufacturer's and customer's) using safe practices and acceptable procedures.

RESOURCES:

A resource list is attached.

GENERAL INSTRUCTIONS:

This course has four units. Each unit has a Unit Learning Experience Guide (LEG) that gives directions for unit completion. Each unit consists of Learning Activity Packages (LAPs) that provide specific information for completion of a learning activity. Pretesting results direct the student to units and performance activities.

The general procedure for this course is as follows:

(1) Read the assigned unit LEG for this course.
(2) Begin and complete the first assigned LAP.
    a. Take and score the LAP test.
    b. Turn in the LAP test answer sheet.
    c. Determine the reason for any missed items on the LAP test.
    d. Proceed to the next assigned LAP in the unit.
    e. Complete all required LAPs for the unit by following steps (a) through (d).
(3) Take the unit tests as described in the Unit LEG "Evaluation Procedures".
(4) Proceed to the next assigned unit in this course.
(5) Follow steps 1 through 4 for all required units for this course.
(6) **This is the last course in the "Plumber Program". Your program will be completed with successful mastery of the last assigned unit in this course.**

You will work independently unless directed to do otherwise. When questions or problems arise, you are expected to discuss them with the instructor. At all times remember to follow correct safety procedures during the performance activity.

UNIT TITLES:

.01 Pipe and Fittings
.02 Cold Water Supply
.03 Hot Water Supply
.04 Fixtures

EVALUATION PROCEDURE:

Course evaluation is by pre and post testing using a multiple-choice type of test.

In this course, the course test is used as a pretest to determine which units, if any, the student may be able to validate. The student is considered validated for a particular unit if 4 out of 5 items are correctly answered for each LAP part on the course pretest and that particular unit does not have a performance test requirement.

EVALUATION PROCEDURE: (cont.)

For those units with performance test requirements, the student must also satisfactorily complete the performance test to validate that unit. Unit performance test validation procedures are given in the "Evaluation Procedure" section of the unit Learning Experience Guide (LEG).

The course test will also be taken by the student as a post test to determine any changes resulting from taking all or part of the course.

FOLLOW-THROUGH:

Go to the first assigned unit Learning Experience Guide (LEG) listed on your Student Progress Record (SPR).

RESOURCE LIST

Printed Materials

1. Blueprint Reading for Plumbers: Residential and Commercial. D'Arcangelo, Delmar Publishers, 1973.
2. Collection of plumbing supply catalogs.
3. Collection of manufacturer's specification sheets.
4. Fixture Rough-in Book (any plumbing fixture manufacturer).
5. The Know-How of Wards Simplified Plumbing, (Modern, Easy-to-Install Water and Drainage Systems). Montgomery Wards.
6. Montana State Plumbing Code.
7. Plumbers and Pipe Fitters Library: Drainage, Fittings, Fixtures, Volume 2. Jules Oravetz, Sr., Theodore Audel and Company, 1967.
8. Related Information Plumbing 1. Harry Slater, Delmar Publishers, 1958.
9. Related Information Plumbing 2. Harry Slater, Delmar Publishers, 1959.

Audio/Visuals

none

Equipment

1. Bender, tube.
2. Brushes, fitting, cleaner (assorted).
3. Cutter, pipe, plastic.
4. Cutter, pipe, soil.
5. Drill, electric.
6. Furnace, lead melting.
7. Hard hats.
8. Irons, caulking.
9. Ladle, lead handling.
10. Pot, lead.
11. Swaging tool.
12. Threader/Reamer/Cutter, pipe, power combination.
13. Tools, basic (plumber): bit, drill (set) (1/16 to 1/4 inch)
    - box, tool
    - chalk line
    - cutter, tubing (1/8 to 5/8 inch)
    - cutter, tubing (imp)
    - flaring tool
    - hacksaw
    - hammer, claw (16 oz.)
    - plier, channel lock
    - rule, steel (12 ft.)
    - screwdriver (4 in one)
    - square, combination (12 inch)
    - wrench, Allen (set)
    - wrench, open-end, adjustable (6 and 8 inch)
    - wrench, open-end/box, combination (3/8 to 3/4 inch)
    - wrench, pipe (12 inch)

14. Torch and tank, Presto Lite or equivalent.
15. Vice, pipe.
16. Wrench, basin.
17. Wrench, pipe (14, 18, 24 and 36 inch).

5/22/75

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COURSE PRETEST: SUPPLY PIPING SYSTEMS

73.02.01.01

1. Which of the following pipe nipples can be purchased chrome or tin-plated?

   a. Galvanized steel.
   b. Black steel.
   c. Brass.
   d. Wrought iron.

2. What is the next length of a nipple longer than 4 1/2"?

   a. 4 5/8".
   b. 4 3/4".
   c. 5".
   d. 4 7/8".

3. Which of the following metals is not used for the construction of pipe nipples?

   a. Brass.
   b. Copper.
   c. Galvanized steel.
   d. Wrought iron.

4. What type of pipe nipple is illustrated below?

   a. Tank.
   b. Close.
   c. Long.
   d. Shoulder.

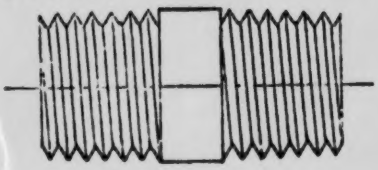


Diagram 3

5. What type of pipe nipple is depicted below?

   a. Long.
   b. Shoulder.
   c. Tank.
   d. Close.

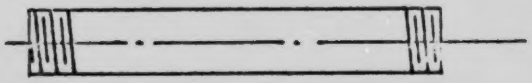


Diagram 4

73.02.01.02

6. In what sizes (inside diameter) are pipe elbows available?

   a. 1/16" - 14".
   b. 1/4" - 6".
   c. 3/8" - 10".
   d. 1/8" - 8".

7. In which of the following weights are brass fittings made?

   a. Medium and extra heavy.
   b. Medium and heavy.
   c. Standard and extra heavy.
   d. Standard and heavy.

8. Elbows are usually made of:

   a. malleable iron.
   b. galvanized steel.
   c. copper.
   d. brass.

9. What type of iron elbow is used on air, oil lines or railings?

   a. Galvanized iron.
   b. Black iron.
   c. Black cast iron.
   d. Wrought iron.

10. What type of elbow is used on pipe coils?

   a. Return elbow.
   b. Lug elbow.
   c. Service elbow.
   d. Reducing elbow.

73.02.01.03

11. A tee having a branch larger than the run is called a:

   a. enveloping tee.
   b. standard increasing tee.
   c. bull head tee.
   d. straight tee.

12. "Y's" have a branch on which of the following angles?

    a. 60 degrees.
    b. 30 degrees.
    c. 45 degrees.
    d. 90 degrees.

13. A 1 1/2" branch is to be connected to a 2" water main. What fitting is used?

    a. A 2" x 1 1/2" galvanized reducing tee.
    b. A 2" x 1 1/2" galvanized straight tee.
    c. A 1 1/2" x 2" galvanized increasing tee.
    d. A 2" x 1 1/2" black cast iron cross.

14. Specify the galvanized malleable fitting shown below:

    a. a 2" x 1 1/4" black cast iron cross.
    b. a 2" x 1 1/4" x 2" x 1 1/4" cast iron cross.
    c. a 2" x 2" black cast iron tee.
    d. a 2" x 1 1/4" black cast iron reducing coupling.

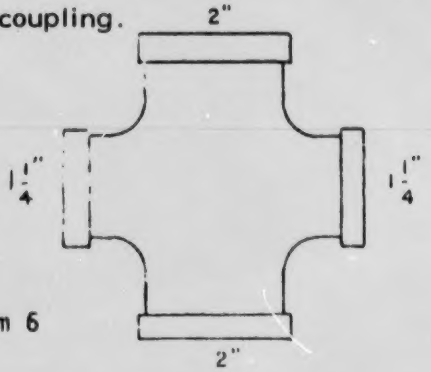


Diagram 6

15. How many outlets has a tee and what angle are they to one another?

    a. 3 outlets; 45 degrees between each.
    b. 4 outlets; 45 degrees between each.
    c. 2 outlets; 180 degrees between each.
    d. 3 outlets; 90 degrees between each.

73.02.01.04

16. A union consists of how many parts?

    a. 4.
    b. 3.
    c. 2.
    d. 5.

17. Unions are constructed in different weights to withstand:

    a. 100 - 150 lbs. of pressure per square inch.
    b. 150 - 250 lbs. of pressure per square inch.
    c. 50 - 75 lbs. of pressure per square inch.
    d. 200 - 400 lbs. of pressure per square inch.

18. For water lines, unions are made of:

    a. Black cast iron.
    b. Galvanized iron or brass.
    c. Wrought iron.
    d. Galvanized steel or copper.

19. If specifying the size of a boiler union elbow, which of the following information is given first?

    a. Tube size.
    b. Outside end.
    c. Supply end.
    d. Name of fitting.

20. The size of boiler union elbows most used are:

    a. 3/4" and 1".
    b. 1/2" and 3/4".
    c. 1" and 1 1/2".
    d. 1/4" and 1/2".

73.02.01.05

21. What are the three types of bushings?

    a. Face, eccentric and off-center.
    b. Octagon, square, and hexagon.
    c. Off-center, square, and face.
    d. Hexagon, face, and eccentric.

22. Reducing couplings are made in sizes from:

    a. 1" x 3/4" to 5" x 3 3/4".
    b. 1/8" x 1/2" to 6" x 2".
    c. 1/4" x 1/8" to 4" x 3 1/2".
    d. 1/2" x 1/2" to 4" x 4".

23. It is desired to connect a 1 1/2" oil pipe to a tank with a 2" tapping. What fitting should be specified?

    a. A 2" x 1 1/2" copper bushing.
    b. A 1 1/2" x 2" black cast iron bushing.
    c. A 2" x 1 1/2" galvanized bushing.
    d. A 2" x 1 1/2" black iron bushing.

24. What fitting could be used to reduce a steam main which would serve the same purpose as an eccentric bushing?

    a. Off-center increasing coupling.
    b. Hexagon bushing.
    c. Eccentric reducing coupling.
    d. Face bushing.

25. What type of bushing should be used in water lines or outside piping where rusting is possible?

    a. Brass bushing.
    b. Black cast iron bushings.
    c. Copper bushings.
    d. Steel bushings.

73.02.02.01

26. Which of the following is a disadvantage of copper tubing?

    a. Its degree of expansion.
    b. It is impervious to rust.
    c. Bends easily around obstructions.
    d. Can withstand freezing several times before breaking.

27. Type "K" copper tubing is furnished in:

    a. 20' lengths.
    b. 60' coils.
    c. 40' coils.
    d. 30' lengths.

28. When using a tubing cutter, at what point should the cutter wheel be placed?

    a. 1/2" from the point where the cut is desired.
    b. 1/4" from the point where the cut is desired.
    c. At the point where the cut is desired.
    d. 1/8" from the point where the cut is desired.

29. How many revolutions should be made around the copper tubing with the tubing cutter before setting the cutter wheel a little deeper?

   a. 2.
   b. 3.
   c. 4
   d. 1.

REFER TO THE TABLE ON THE FOLLOWING PAGE FOR THE NEXT QUESTION:

30. What is the difference in weight of 1' of 3" K and L type copper tubing?

   a. 67.0 lbs.
   b. 6.7 lbs.
   c. 0.067 lbs.
   d. 0.67 lbs.

73.02.02.02

31. Which of the following tools is used to enlarge the end of copper tubing?

   a. Reamer.
   b. Swage.
   c. Pilot insert.
   d. Honing bar.

32. Swaging is a preparation of which of the following?

   a. Cementing.
   b. Welding.
   c. Soldering.
   d. Taping.

33. After each tap the swaging tool should be:

   a. turned slightly.
   b. removed from the tubing.
   c. lubricated with light machine oil.
   d. cleaned with emery cloth.

34. Which of the following hammers are recommended for use when swaging copper tubing:

   a. ball peen.
   b. claw hammer.
   c. fiberglass head hammer.
   d. 16 oz stanley ripping hammer.

THE TABLE PROVIDED BELOW IS FOR QUESTION NUMBER 30:

Diagram 14

SIZES AND WEIGHTS OF COPPER WATER TUBE

(In accordance with Simplified Practice Recommendation R217-46)

Standard Water Tube Size	Actual Outside Diameter	Nominal Wall Thickness			Theoretical Weight		
		Type K	Type L	Type M	Type K	Type L	Type M
Inches	Inches	Inches	Inches	Inches	Lb./Ft.	Lb./Ft.	Lb./Ft.
⅜	0.500	0.049	0.035	.....	0.269	0.198	.....
½	.625	.049	.040	.....	.344	.285	.....
⅝	.750	.049	.042	.....	.418	.362	.....
¾	.875	.065	.045	.....	.641	.455	.....
1	1.125	.065	.050	.....	.839	.655	.....
1¼	1.375	.065	.055	.....	1.04	.884	.....
1½	1.625	.072	.060	.....	1.36	.114	.....
2	2.125	.083	.070	.....	2.06	1.75	.....
2½	2.625	.095	.080	0.065	2.93	2.48	2.03
3	3.125	.109	.090	.072	4.00	3.33	2.68
3½	3.625	.120	.100	.083	5.12	4.29	3.58
4	4.125	.134	.110	.095	6.51	5.38	4.66
5	5.125	.160	.125	.109	9.67	7.61	6.66
6	6.125	.192	.140	.122	13.9	10.2	8.92
8	8.125	.271	.200	.170	25.9	19.3	16.5
10	10.125	.338	.250	.212	40.3	30.1	25.6
12	12.125	.405	.280	.254	57.8	40.4	36.7

35. When swaging copper tubing, which of the following tools should be used to hold the tubing?

    a. Channel lock pliers.
    b. Vice.
    c. Vice grip pliers.
    d. Flaring block.

73.02.02.03

36. **Before two pieces of tubing are soldered together, what should be done to assure a complete bond?**

    a. Both ends should be swaged.
    b. Both ends should be reamed.
    c. Application of flux.
    c. Only one end should be reamed.

37. To cut the end of a copper tubing squarely, which of the following tools should be used?

    a. Hacksaw with 20 teeth per inch.
    b. Tube cutter.
    c. reamer.
    d. Sabre saw.

38. What is the result if a burr is not removed from a piece of copper tubing about to be soldered?

    a. Reduces the flow of water.
    b. Inhibits a good solder joint.
    c. Will cause a cold solder joint.
    d. Prevents a uniform fit of the two pieces of tubing.

39. Which of the following tools would be used to remove the burr that results after cutting copper tubing?

    a. Internal tap.
    b. Rasp.
    c. File.
    d. Reamer.

40. To distribute the solder flux after applying it to an end on a piece of copper tubing:

    a. heat the filling and tubing.
    b. rotate the tubing in the fitting.
    c. use a cloth, not your finger.
    d. use a tubing cleaner.

73.02.02.04

41. What do the letters I.P.T. stand for?

    a. inside pipe thickness.
    b. iron pipe thread.
    c. internal potential thermostat.
    d. inferior pipe tubing.

42. Wrought-type solder fittings are made in sizes from:

    a. 1/2" - 6"
    b. 1/8" - 4".
    c. 1/8" - 12".
    d. 1/4" - 8".

43. A 45 degree cast elbow is commonly called which of the following?

    a. 1/4 bend.
    b. 1/8 bend.
    c. 1/6 bend.
    d. 1/2 bend.

44. Which of the following would properly identify a copper angle fitting that is to be attached to a section of iron pipe?

    a. 3/4" IPT to 1/2" copper.
    b. 1/2" IPT to 1/2" copper.
    c. 1/2" copper to 1/2" IPT.
    D. 3/4" IPT to 1/2" copper.

45. Which of the following specifies a fitting which could be used with a 1" galvanized iron pipe to extend two 3/4" soft copper tubes at 90° in opposite directions?

    a. 1" IPT to 3/4" copper to 3/4" copper flared tee.
    b. 3/4" copper to 3/4" copper to 1" IPT flared tee.
    c. 3/4" copper to 1" IPT to 3/4" copper flared tee.
    d. 1/2" IPT to 3/4" copper to 1/2" copper flared tee.

73.02.02.05

46. Branch fittings are basically:

    a. wyes and elbows.
    b. elbows and crosses.
    c. wyes and tees.
    d. crosses and tees.

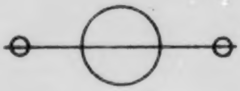
73.02.02.05 (continued)

47. When making a solder joint using a branch fitting, the source of heat (torch) should:

    a. be directed in the direction of solder flow.
    b. be held in one position.
    c. be directed to the inside of the fitting.
    d. be kept moving to distribute the heat.

48. What fitting is indicated by this symbol?

    a. tee.
    b. elbow.
    c. Y branch
    d. coupling.



49. What type of joint is indicated in the symbol in question 48?

    a. screwed.
    b. welded.
    c. soldered.
    d. flanged.

50. What direction is the fitting facing, in relation to you, in question 48?

    a. it is not indicated.
    b. toward you.
    c. parallel with you.
    d. away from you.

73.02.02.06

51. Which of the following is used to close the opening in a sweat fitting?

    a. cap fitting.
    b. plug fitting.
    c. crossover.
    d. drain tee.

52. What type of copper sweat fitting is used when it is difficult to estimate the angle required?

    a. fitting reducer.
    b. flexible coupling.
    c. union.
    d. drain coupling.

73.02.02.06 (continued)

53. Which of the following sweat fittings is used to close off the end of a copper tube?

    a. crossover.
    b. plug fitting.
    c. cap fitting.
    d. reducing coupling.

54. The sweat fitting which is used to allow easy disassembly of pipe system parts is a:

    a. sweat bushing.
    b. union.
    c. fitting reducer.
    d. air chamber.

55. To eliminate water hammer, a plumber should install a:

    a. air chamber.
    b. female adapter.
    c. union.
    d. bushing.

73.02.02.07

56. What type of valves are usually used on supply lines to faucets to allow for repairing purposes?

    a. globe valves.
    b. compression valves.
    c. gate valves.
    d. check valves.

57. Water pressure on a compression valve should always be where?

    a. pressure position is not important.
    b. over the disc of the valve.
    c. under the disc of the valve.
    d. pressure should come from the top down in a compression valve.

58. Ground key cocks never contain which of the following?

    a. threads.
    b. washers.
    c. tee handle.
    d. tapered plug.

73.02.02.07 (continued)

59. What tool would be most appropriate for turning a square head handle on a ground key cock?

a. monkey wrench.
b. pliers.
c. six point socket.
d. ten point socket.

60. If a ground key cock has a small leak, which of the following would you try first to stop the leak?

a. loosen the handle.
b. remove it and lubricate.
c. tighten the nut slightly.
d. remove and replace the valve body.

73.02.02.08

61. What would be the result if the curb step turned after the curb box was installed?

a. key could be turned off but not on.
b. no problem would develop.
c. key could be turned on but not off.
d. key could not be turned.

62. How close should the shutoff valves be placed in relation to a small water meter?

a. at least 3' from the meter.
b. within 12".
c. valves are not needed.
d. depends upon how many valves are needed.

63. What must be considered when installing a water meter?

a. easy reading.
b. distance from the curb.
c. the distance in relation to water supply entrance.
d. the water pressure.

64. The plumber should blow out all supply lines before installing which of the following?

a. coupling.
b. water meter.
c. angle fitting.
d. ground cock.

73.02.02.08 (continued)

65. When is the one foot dial used?

    a. when testing water meters.
    b. when testing water pressure.
    c. when testing water solvency.
    d. when determining water hardness.

73.02.02.09

66. Where would you look in a basement for the valve to shut off all the water for the entire house?

    a. near the water heater.
    b. near the water softener.
    c. where the service pipe enters the house.
    d. near the house drain.

67. What type(s) of valve(s) are used on service pipes in the house?

    a. check.
    b. globe.
    c. compression or gate.
    d. ball cock.

68. What tool is used to shut the water off in a service pipe?

    a. stop key.
    b. pipe wrench.
    c. monkey wrench.
    d. wheel.

69. When comparing galvanized pipe to copper pipe, what must be considered?

    a. comparison depends on the particular application or use.
    b. a larger copper pipe than galvanized pipe must be installed to do the same job.
    c. they are equal.
    d. a larger galvanized pipe than copper pipe must be installed to do the same job.

70. Due to corrosion, in approximately ten years, friction will double in what type or kind of pipe?

    a. type of copper.
    b. galvanized.
    c. type M copper.
    d. type L copper.

73.02.02.10

71. On the first floor of a building there is 65 pounds of pressure on the plumbing supply system. How much pressure is on the second floor, fifteen feet above?

    a. 71.51 lbs.
    b. 58.49 lbs.
    c. 64.566 lbs.
    d. 55.49 lbs.

72. What pressure is exerted per square inch on a swimming pool that is 9 feet deep at the deep end?

    a. 9 lbs.
    b. 4.507 lbs.
    c. 3.906 lbs.
    d. .434 lbs.

73. When a pressure gauge that is installed on a system reads 30 lbs., what does this really mean?

    a. 30 lbs. pressure against every 10 square inches of exposed area in the system.
    b. 30 lbs. pressure against the total exposed area of the system.
    c. 30 lbs. pressure against every square inch of exposed area in the system.
    d. 30 lbs. pressure against every 100 square inches of exposed area in the system.

74. The Bourden principle is best demonstrated in which of the following?

    a. pressure gauge.
    b. valve.
    c. water pipe.
    d. flexible coupling.

75. The principle that states that pressure tends to straighten hose, is best demonstrated in which of the following?

    a. pipe wrench.
    b. valve.
    c. pressure gauge.
    d. faucet.

73.02.02.11

76. What type of pipe would you select for water piping?

    a. glass pipe.
    b. steel pipe.
    c. galvanized pipe.
    d. copper tubing.

73.02.02.11 (continued)

77. Which of the following illustrations displays the least amount of friction loss?

   a. Fig. 5
   b. Fig. 2
   c. Fig. 4
   d. Fig. 3

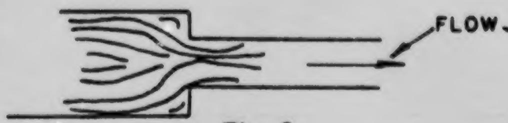


Fig. 2

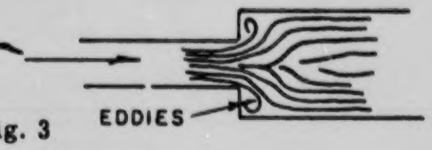


Fig. 3

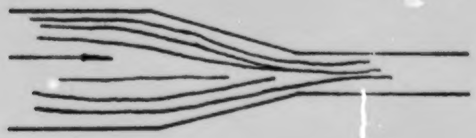


Fig. 4

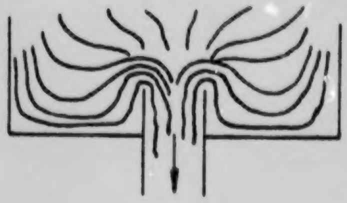


Fig. 5

78. What is the friction loss in pounds in a 1 inch pipe 100 feet long with a velocity of 20 gallons per minute?

   a. 59 lbs. per 100' of pipe.
   b. 18 lbs. per 100' of pipe.
   c. 5 lbs. per 100' of pipe.
   d. 38 lbs. per 100' of pipe.

79. The flow in iron pipe will be decreased by what % in 15 years?

   a. 50-75%
   b. 10-15%
   c. 25-50%
   d. 33 1/3-66 2/3%

80. A 1/2" water main 150 feet long, with 45 pounds pressure, fails to supply fixtures at the rate of 8 gallons per minute. How could this be remedied?

   a. change the supply pipe to 1".
   b. change water main.
   c. water pressure should be decreased.
   d. change supply pipe to 3/4".

73.02.02.12

81. Why is the water in lakes and rivers generally impure?

   a. exposed to too much atmospheric pressure.
   b. when running over the ground, it picks up all sorts of impurities.
   c. exposed to too little atmospheric pressure.
   d. the lack of surface water movement.

73.02.02.12 (continued)

82. How many and what types of gases make up water?

    a. three - oxygen, hydrogen, and nitrogen.
    b. two - hydrogen and oxygen.
    c. two - oxygen and nitrogen.
    d. four - carbon dioxide, nitrogen, hydrogen, and argon.

83. What is the chemical symbol of water:

    a. HON.
    b. H_2O.
    c. N_3O.
    d. C_2ONH_4X.

84. At atmostpheric pressure (about 15 lbs.), water will absorb up to:

    a. 4% of its volume.
    b. 10% of its volume.
    c. 2% of its volume.
    d. 8% of its volume.

85. How many parts lead per million parts of water constitutes a poisonous mixture?

    a. 1
    b. .5
    c. 3
    d. 25

73.02.03.01

86. When using a grabber flaring tool, approximately how far should the tubing extend up from the flaring block?

    a. 3 8"
    b. 1/8"
    c. 1/2"
    d. equal to the diameter of the pipe to be flared.

87. If a flared joint is to be made on a system using soft copper tubing, which of the following tools or supplies would not be needed?

    a. sleeve.
    b. tubing cutter.
    c. flare nut.
    d. fitting.

73.02.03.01 (continued)

88. Which number would identify an isometric view of a flare fitting in the diagram below?

    a. 9
    b. 10
    c. 5
    d. 8

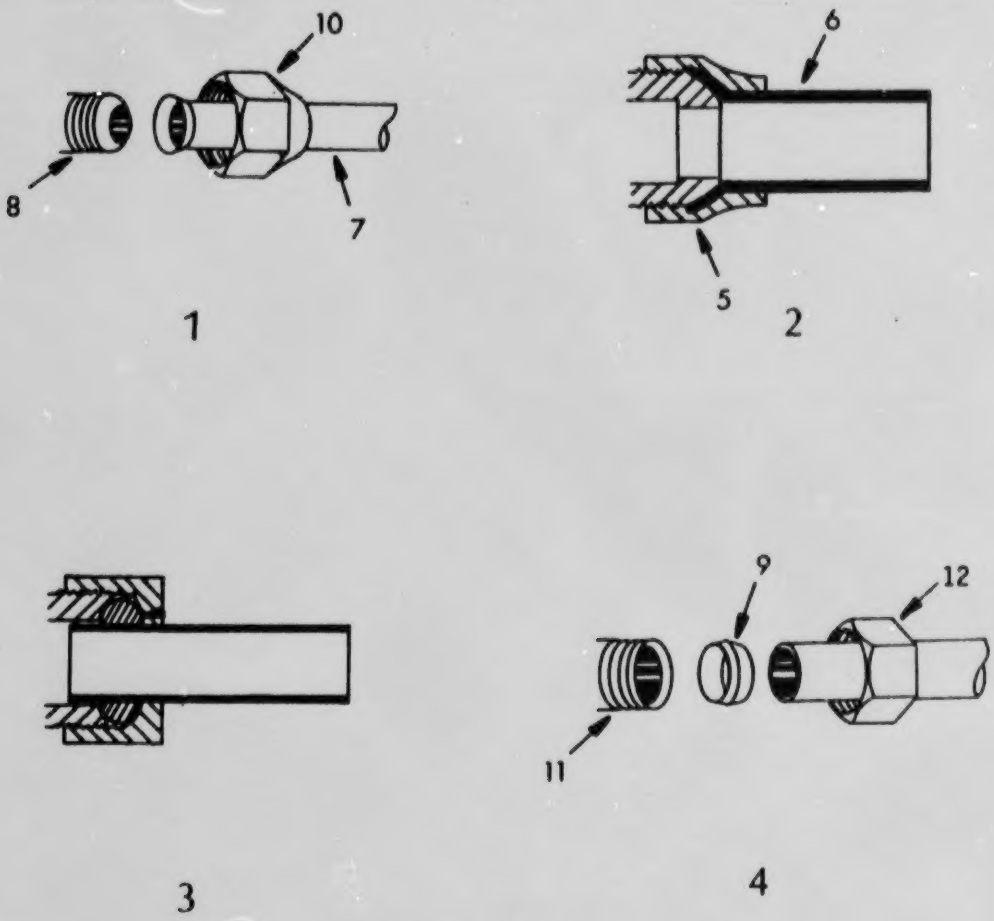

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Diagram 27

73.02.03.01 (continued)

89. Which numbers would correspond to a pictorial description of a flare joint? (Use the diagrams on page 17.)

a. 2,3
b. 3,4
c. 1,4
d. 1,2

90. Which of the following numbers would identify a cross section of a compression nut? (Use the diagrams on page 17).

a. 10.
b 7.
c. 9.
d. 12.

73.02.03.02

91. What is the name of the tool used to prepare soft copper tubing for a flared joint?

a. paring tool.
b. flaring tool.
c. mitre tool.
d. mitre gauge.

92. which of the following numbers would correspond to a female elbow? (Use diagram on page 19.)

a. 11
b. 12
c. 10
d. 9

93. Which of the following numbers would correspond to an illustration of a tee? (Use diagram on page 19.)

a. 2
b. 1
c. 9
d. 10

94. Which of the following numbers would correspond to an illustration of an outside cap? (Use diagram on page 19.)

a. 12
b. 5
c. 6
d. 8

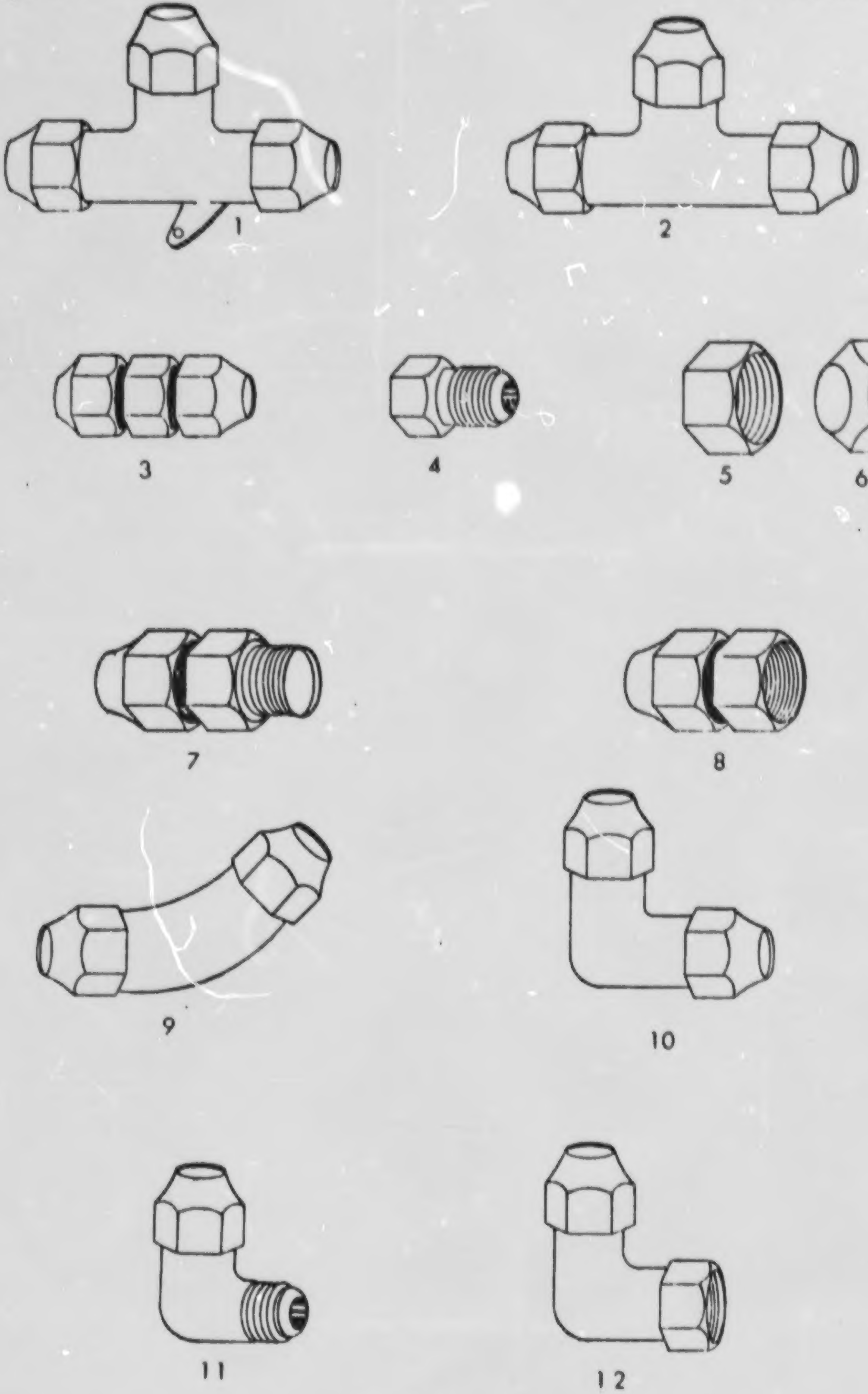
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Diagram 28

73.02.03.02 (continued)

95. Which of the following numbers would correspond to an illustration of a plug? (Use diagram on page 19.)

    a. 5
    b. 4
    c. 6
    d. 8

73.02.03.03

96. How many times its own volume will a cubic inch of water expand when heated to steam?

    a. 10 times.
    b. 1728 times.
    c. 10,743 times.
    d. 1,100 times.

97. How much in gallons will the water in a thirty-gallon boiler expand when heated from 60 to 212 degrees?

    a. 5.5 gallons.
    b. 1.15 gallons.
    c. .5 gallons.
    d. 7.2 gallons.

98. How many BTUs will raise the water in a 5' x 22" boiler from 60 degrees to 140 degrees?

    a. 879,420 BTUs.
    b. 564, 320 BTUs.
    c. 66,640 BTUs.
    d. 79,320 BTUs.

99. How many BTUs will raise 40 gallons of water from 40 degrees to the boiling point?

    a. 59,620 BTUs.
    b. 7,840 BTUs.
    c. 57,310 BTUs.
    d. 62,430 BTUs.

100. When water is heated by a hot water tank and no water is drawn from the tank, where does the expanded water go?

    a. it expands the tank.
    b. nowhere.
    c. back into the main.
    d. it expands the pipes.

73.02.03.04

101. Which of the following is a good insulator for heat?

    a. wood.
    b. glass.
    c. copper.
    d. dead air space.

102. How should a return be pitched to a heater?

    a. it makes no difference.
    b. level.
    c. up from the tank to the heater.
    d. down from the tank to the heater.

103. What happens to water or air if it is heated?

    a. gets lighter and rises.
    b. gets heavier and falls.
    c. remains the same.
    d. no pattern can be determined.

104. How is the heat within a radiator transmitted to a room?

    a. by convection and radiation.
    b. by convection.
    c. by convection and conduction.
    d. by conduction and radiation.

105. How is heat lost in a room of a house?

    a. by radiation to outside weather.
    b. by convection to outside weather.
    c. by saturation to outside weather.
    d. by conduction to outside weather.

73.02.03.05

106. If the outlet of the furnace coil is lower than the end that is in the fire, what would result?

    a. water hammer.
    b. explosion.
    c. extreme temperature variation.
    d. no problem would exist.

73.02.03.05 (continued)

107. The flow pipe from the tank connects to what topping of a longated tank?

- a. bottom right side.
- b. center.
- c. bottom left side.
- d. top tapping.

108. How far from the top should the hole in a boiler tube be positioned (maximum)?

- a. 18".
- b. 6".
- c. 1".
- d. 2".

109. A horizontal tank that is 18" x 60" would have what capacity?

- a. 25 gallons.
- b. 30 gallons.
- c. 100 gallons.
- d. 60 gallons.

110. If you put a 4'8" tube in a typical 30 gallon hot water tank, what would happen?

- a. water would discolor.
- b. water flow would burn out the elements.
- c. there is nothing wrong.
- d. the water temperature would be too high.

73.02.03.06

111. Where should relief valves be installed?

- a. no closer than 10 feet.
- b. no closer than 5 feet.
- c. in or close to the tank.
- d. location is not important.

112. If the burner on a gas heater fails to light, what should you do?

- a. follow the same procedure again.
- b. proceed with caution.
- c. wait five minutes.
- d. wait thirty minutes.

73.02.03.06 (continued)

113. At what discharge pressure would you set a relief valve where the existing pressure is 40 pounds?

a. 20 pounds.
b. 60 pounds.
c. 80 pounds.
d. 50 pounds.

114. To increase the pressure of a spring type relief valve:

a. slide the sleeve up.
b. loosen the adjusting screw.
c. tighten the adjusting screw.
d. move the lever clockwise.

115. Which of the following would be a correctly ordered lever and weight type relief valve for a typical hot water heater installation?

a. 1/2" brass lever and weight relief valve for 75 lbs.
b. 1/2" iron lever and weight relief valve for 150 lbs.
c. 2 1/2" brass lever and weight relief valve for 150 lbs.
d. 3" brass lever and weight relief valve for 175 lbs.

73.02.03.07

116. On the illustration of the gas water heater, which number would identify the cold water supply. (Use diagram on page 24.)

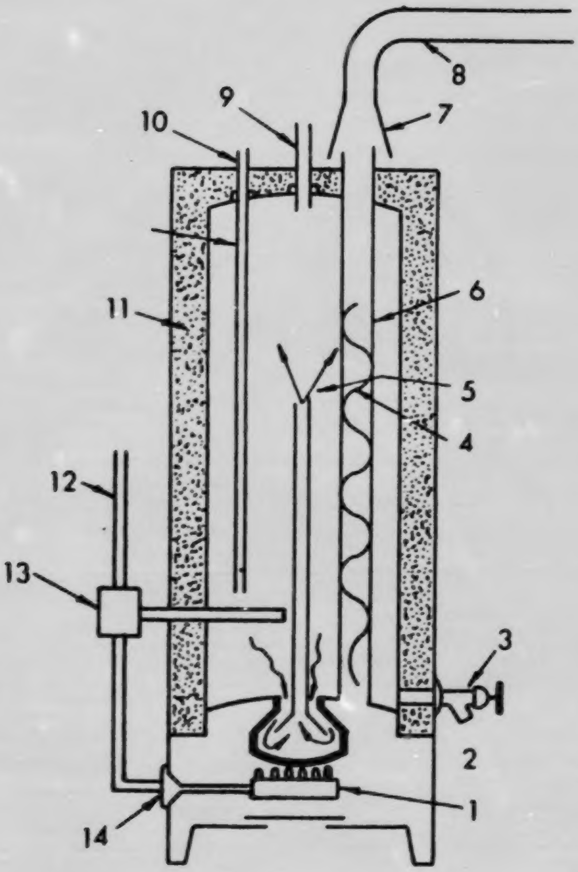
a. 8
b. 9
c. 3
d. 10

117. The illustration of the gas water heater on page 24, which number would correspond to the hot water supply?

a. 12
b. 10
c. 9
d. 8

118. Which number would identify the thermostat on the illustration of the gas water heater on page 24?

a. 1
b. 14
c. 4
d. 13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14

Diagram 29 Automatic Gas Water Heater

73.02.03.07 (continued)

119. On the illustration of the gas water heater on page 24, which number would identify the air shutter?

a. 14
b. 13
c. 4
d. 6

120. On the illustration of the electric water heater on page 26, which number would identify the thermostat?

a. 1
b. 4
c. 9
d. 3

73.02.03.08

121. What is the approximate temperature of a properly functioning Bunsen Burner?

a. 450°.
b. 2,250°.
c. 4,850°.
d. 12,000°.

122. Through which of the following does the Bunsen Burner get its primary air supply?

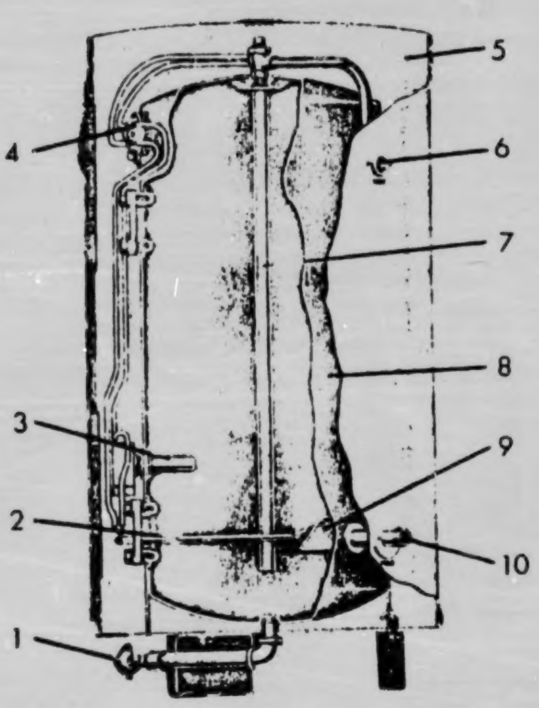
a. air shutter.
b. nozzle.
c. regulator.
d. air valve.

123. Which of the following would be used to clean and empty a tank heater?

a. draw off cock.
b. flow pipe.
c. relief valve.
d. hot water supply.

124. What is the disadvantages of a long draw off pipe that has many fittings?

a. BTU loss.
b. hot water will not flow.
c. heat loss.
d. friction loss.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1

Diagram 30

73.02.03.08 (continued)

125. Why does the hot water travel out the top pipe on a tank heater?

   a. hot water is lighter than cold.
   b. hot water is heavier than cold.
   c. cold water is lighter than hot water.
   d. hot water does not travel unless under line pressure.

73.02.04.01

126. If you lost the rubber washer for a slip joint, what could be used in its place?

   a. lampwick or graphite packing.
   b. pipe dope.
   c. fiber glass packing.
   d. steel wool packing.

127. Which of the following joints should not be installed on the sewer side of a sink drain?

   a. screwed.
   b. sweat.
   c. welded.
   d. slip joint.

128. What should you do if a mistake has been made in rough-in? For example, the OC center on the rough-in is 8" and the faucet OC is 6".

   a. obtain a different faucet.
   b. remove and replace the rough-in installation.
   c. use soft copper supplies.
   d. use flexible supplies.

129. What type of joint is used on the lower end of a supply pipe?

   a. compression joint.
   b. flared joint.
   c. screwed joint.
   d. ground joint.

130. Upon which of the following does the lower end of the supply pipe depend for a water tight joint?

   a. pipe dope.
   b. proper flare.
   c. sleeve.
   d. seat.

73.02.04.02

131. Which type of lavatory faucet should be used in a public toilet room?

   a. quick precision.
   b. compression.
   c. globe.
   d. self closing.

132. Which of the following faucets uses a spring?

   a. self closing.
   b. compression.
   c. quick precision.
   d. globe.

133. Which of the following finishes gives the best appearance?

   a. nickel plated.
   b. polished brass.
   c. polished copper.
   d. chrome plated.

134. Which of the following would best describe the difference between a quick precision faucet and a compression faucet?

   a. seat.
   b. depth of stem.
   c. spring.
   d. pitch of threads.

135. Faucets are usually constructed out of what type of material?

   a. steel.
   b. copper.
   c. brass.
   d. zinc.

73.02.04.03

136. If you found a situation in a lavatory that would allow the water to overflow the sinks if the stopper was in place, what would you install?

   a. an overflow.
   b. bypass.
   c. another drain connection.
   d. a self closing faucet.

73.02.04.03 (continued)

137. The waste and overflow pipe dimensions are measured how?

    a. inside diameter.
    b. outside diameter.
    c. circumference.
    d. there is no uniform standard of measurement.

138. Of what material is the speedway supply pipe made?

    a. brass.
    b. stainless steel.
    c. annealed copper.
    d. chromium

139. How do you connect a waste and overflow to a lead joint?

    a. use a sleeve.
    b. use a compression joint.
    c. thread the lead with a tap.
    d. flare lead and solder.

140. On a connected waste and overflow what holds the top elbow in place?

    a. solder.
    b. brass nut.
    c. set screw.
    d. putty.

73.02.04.04

141. Of what metal are strainers made?

    a. brass.
    b. aluminum.
    c. copper.
    d. iron.

142. On a duplex strainer what is first placed on the strainer outside the sink?

    a. the gasket.
    b. the locknut.
    c. plug
    d. coupler washer.

73.02.04.04 (continued)

143. In the illustration of the duplex sink strainer below, which number would correspond to the plug?

a. 5
b. 7
c. 6
d. 1

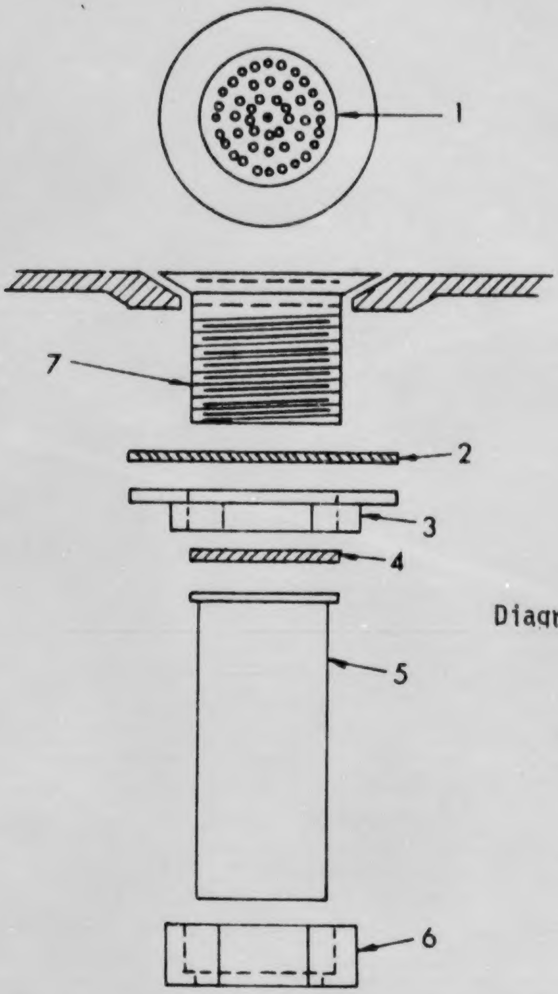


Diagram 35

73.02.04.04 (continued)

144. In the illustration of the P.O. Plug below, which number would correspond to the locknut?

   a. 3
   b. 1
   c. 2
   d. 4

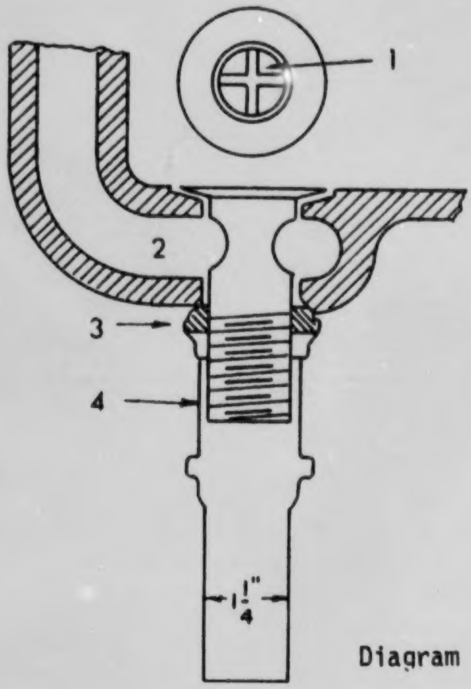


Diagram 36

73.02.04.04 (continued)

145. In the illustration below of the strainer with a plug, which number would correspond to the tail piece.

a. 4
b. 3
c. 5
d. 6

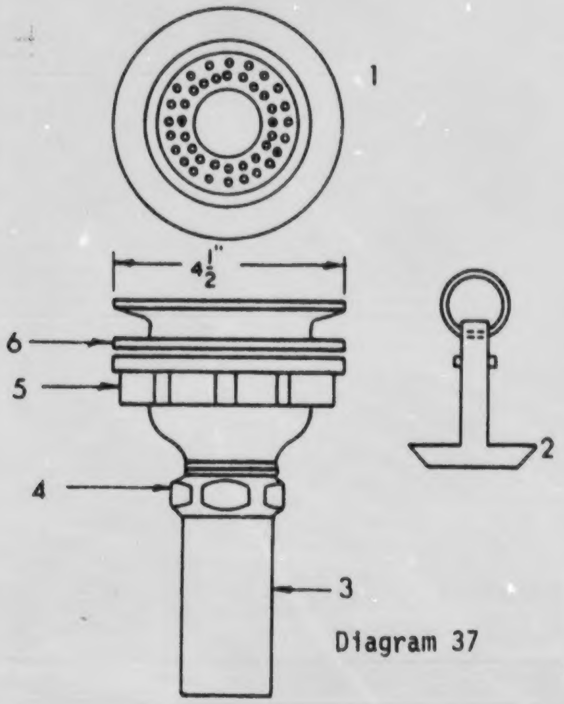


Diagram 37

73.02.04.05

146. Usually, how much lower is the mounting bracket on a wall hung sink than the top of the fixture itself?

a. 1 1/2"
b. 3"
c. 5"
d. 6"

147. When mounting the bracket for a wall hung sink, which screw should be inserted first?

a. it makes no difference.
b. left hand.
c. right hand.
d. center.

148. Which of the following is usually the on-center spacing of studs in homes?

a. 48" O.C.
b. 20" O.C.
c. 36" O.C.
d. 16" O.C.

149. Where would you find out what is to be the height of a particular fixture?

a. from city engineer.
b. from home owner.
c. from blueprints.
d. from fixture specifications.

150. After installing the first screw in a wall hung sink bracket, what is the next step?

a. install the rest of the screws.
b. hang the sink.
c. level the bracket.
d. install the trap.

73.02.04.06

151. How is the initial line for cutting a sink hole usually accomplished?

a. use a scriber.
b. measure the sink and then transfer the measurements to the counter top.
c. turn sink upside down on the counter top.
d. use a prick punch and T-square.

73.02.04.06 (continued)

152. **When roughing in a kitchen sink, approximately how high off a finished floor should the waste be roughed in?**
   a. 12"
   b. 24"
   c. 6"
   d. 18"

153. Approximately how far off center should the waste of a typical sink be installed?

   a. 14"
   b. 12"
   c. 8"
   d. 4"

154. When should the faucets be installed in a typical sink installation?

   a. after chips have been tightened.
   b. last.
   c. just before turning on the water supply.
   d. before sink is dropped in its opening.

155. Under what conditions would an island sink installation require a two pipe drainage system?

   a. if the run to the stack is over 8' away.
   b. if it is over 3' wide.
   c. if it has a garbage disposal.
   d. if pipe size is less than 1".

73.02.04.07

156. What is the minimum size waste a garbabe disposer can be connected to?

   a. 1 1/4"
   b. 1 1/2"
   c. 1"
   d. 1 3/4"

157. What type of tool should be used to turn the nuts on a slip joint used on a garbage disposer installation?

   a. pipe wrench.
   b. monkey wrench or chanel locks.
   c. lock pliers.
   d. socket.

73.02.04.07 (continued)

158. What size piping is required for most disposer installations?

a. 1 1/2"
b. 1 1/4"
c. 1 3/4"
d. 1"

159. If any soldering of the waste system must be done when installing a disposer, which of the following should be installed last?

a. sink sleeve.
b. snap ring.
c. mounting lug on body flange.
d. discharge tube.

160. All garbage disposers must be:

a. connected to a 208 volt system.
b. connected to 220 volts.
c. connected to a polyphase system.
d. grounded.

73.02.04.08

161. What height off the floor should the pipe supplies for a vanity sink be?

a. 21"
b. 24"
c. 12"
d. 6"

162. What is the standard height for a bathroom vanity?

a. 32"
b. 36"
c. 28"
d. 24"

163. What size supply lines are usually run to a vanity sink?

a. 1/2"
b. 3/4"
c. 1"
d. 1 1/4"

73.02.04.08 (continued)

164. When installing the tail piece into a vanity sink, a washer should be placed between the tail piece and the sink. If a washer is not available, which of the following would be a substitute?

  a. plumber's putty.
  b. oakum.
  c. graphite rope.
  d. white glue.

165. Which of the following fittings would be used to project a water supply system out past the finished wall when roughing-in a vanity sink?

  a. nipple.
  b. 90° ell
  c. tee.
  d. yee.

73.02.04.09

166. What size waste is usually installed on a wall hung sink?

  a. 1 1/4"
  b. 1 1/2"
  c. 2"
  d. 1"

167. Which of the following is not a description of a faucet that would be used on a typical wall hung sink?

  a. Moen single control 4" O.C.
  b. V/R dual control 4" O.C.
  c. Moen single lever 8" O.C.
  d. V/R single control 4" O.C.

168. Which of the following is the correct measurement from the finished floor for a typical wall hung sink supply rough-in dimension?

  a. 6"
  b. 12"
  c. 16"
  d. 21"

169. What is the rough-in dimension from the finished floor for the waste on a wall hung sink?

  a. 18"
  b. 12"
  c. 11"
  d. 6"

73.02.04.09 (continued)

170. The bracket on a wall hung sink must be:

a. square.
b. level.
c. plumb.
d. vertical.

73.02.04.10

171. How long is the average bath tub?

a. 4'0"
b. 5'6"
c. 5'0"
d. 4'6"

172. When should a tub be installed?

a. after sheetrock is installed.
b. after complete finishing of bathroom.
c. before final completion of bathroom framing.
d. after finish floor is installed.

173. Before installing the bath tub, what should be done?

a. install the faucets.
b. install the sheetrock.
c. install the finish floor.
d. cut the floor for waste installation

174. For ease of installation when should the bath tub waste be installed?

a. waste installation is the last step in tub installation.
b. after tub has been installed.
c. right after uncrating the tub.
d. before final positioning of the tub.

175. If you are required to install a tub faucet, what is the recommended height of the rough nipple above the tub rim?

a. 10"
b. 4"
c. 2"
d. 12"

73.02.04.11

176. Which of the following traps should be used on most shower installations?

- a. 1 1/2" drum trap.
- b. 2" S trap.
- c. 2" P trap.
- d. 1" S trap.

177. What is the recommended rough-in measurement for the rough nipple that is used on a shower head from the finish floor?

- a. 4'0"
- b. 5'0"
- c. 4'6"
- d. 6'0"

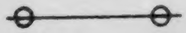
178. When installing the shower head in a shower, the head should be installed so that when a person is taking a shower the water flow is:

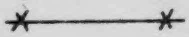
- a. away from the door.
- b. toward the door.
- c. direction of flow is not important.
- d. horizontal, toward the door.

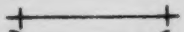
179. When installing a shower base in a typical situation, what typical joint is used to connect the base to the drain?

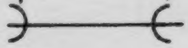
- a. glued joint.
- b. sweat joint.
- c. screwed joint.
- d. lead joint.

180. What is the symbol for a lead joint?

a. 

b. 

c. 

d. 

73.02.04.12

181. From the finished wall to the center of the drain, what are the roughing-in measurements for a free-standing toilet waste?

- a. 6"
- b. 12"
- c. 2'
- d. 18"

73.02.04.12 (continued)

182. What are the roughing-in measurements for a free standing toilet water supply?

   a. 6" from center of toilet and 8" from finished floor on left side.
   b. 18" from center of toilet and 12" from finished floor.
   c. roughing-in isn't important.
   d. 6" from center on right side and 10" from finished floor.

183. As a general rule, how many types of closet bowls are there?

   a. 10
   b. 4
   c. 1
   d. 6

184. On a water closet, how is the close coupled tank fastened to the bowl?

   a. by a brass clamp.
   b. by two lag screws, the water connection sealed by putty.
   c. by a special glue.
   d. by two bolts, the water connection is sealed by a special gasket.

185. What is the most expensive and quietest bowl?

   a. wash down with jet.
   b. wash down bowl
   c. siphon jet bowl
   d. reverse trap bowl.

73.02.04.13

186. What kind of material is used in construction of water closets?

   a. vitreous china.
   b. cast iron.
   c. clay.
   d. enameled steel.

187. What is the approximate rough-in height for the waste of a wall hung toilet?

   a. 7-8"
   b. 2-3"
   c. 4-5"
   d. 6-10"

73.02.04.13 (continued)

188. When roughing in a wall-hung stool, approximately how far through finished walls should 5/8 studs project?
    a. 4"
    b. 1"
    c. 1 7/8"
    d. 3 3/4"

189. Why is the wall hung toilet becoming more popular?
    a. less working parts.
    b. cheaper to buy.
    c. easier to install.
    d. ease of cleaning around and under.

190. What precaution should be used in securing bowl to wall?
    a. tighten bottom bolts only.
    b. tighten top bolts only.
    c. tighten bolts very tight.
    d. tighten bolts evenly and snug, but not too tight.

73.02.04.14

191. What is the best location for a water softener?
    a. outside so you don't need a drain.
    b. inside close to a drain and water supply.
    c. close to hot water heater.
    d. behind the furnace out of the way.

192. What is the main additive to keep a water softener working properly?
    a. lime.
    b. sugar.
    c. gravel.
    d. salt.

193. What should the minimum total pipe run between a softener and a hot water tank?
    a. 8'
    b. 12'
    c. 2'
    d. 6'

73.02.04.14 (continued)

194. What is the purpose of a water softner?

- a. to purify water.
- b. to eliminate bad tasting water.
- c. to reduce certain chemical compounds making hard water domestically useable.
- d. to increase the water supply.

195. What is the main mineral use in water softening?

- a. zeolite.
- b. coal.
- c. gravel.
- d. calcium.

COURSE PRETEST ANSWER KEY

Occupational Area:
File Code: 73.02.00.00.A2-2
Name:

ANSWERS

73.02.01.01	1. C	73.02.01.05	21. D	73.02.02.04	41. B
	2. C		22. C		42. B
	3. B		23. C		43. B
	4. D		24. C		44. C
	5. A		25. A		45. B
3.02.01.02	6. D	73.02.02.01	26. A	73.02.02.05	46. C
	7. C		27. B		47. D
	8. A		28. C		48. A
	9. B		29. A		49. C
	10. A		30. D		50. D
73.02.01.03	11. C	73.02.02.02	31. B	73.02.02.06	51. B
	12. C		32. C		52. B
	13. A		33. A		53. C
	14. A		34. A		54. B
	15. D		35. D		55. A
73.02.01.04	16. B	73.02.02.03	36. C	73.02.02.07	56. B
	17. B		37. B		57. C
	18. B		38. A		58. B
	19. C		39. D		59. A
	20. A		40. B		60. C

COURSE PRETEST ANSWER KEY

Occupational Area: ______________________
File Code: 73.02.00.00.A2-2
Name: ______________________

ANSWERS

.02.02.08	61	D	73.02.02.12	81.	B	73.02.03.04	101.	D
	62.	B		82.	B		102.	D
	63.	A		83.	B		103.	A
	64	B		84.	A		104.	D
	65.	A		85.	B		105.	D
73.02.02.09	66.	C	73.02.03.01	86.	B	73.02.03.05	106.	A
	67.	C		87.	A		107.	D
	68.	A		88.	B		108.	D
	69.	D		89.	D		109.	D
	70.	B		90.	D		110.	A
.02.02.10	71.	B	73.02.03.02	91.	B	73.02.03.06	111.	C
	72.	C		92.	B		112.	C
	73.	C		93.	A		113.	D
	74.	A		94.	C		114.	C
	75.	C		95.	B		115.	A
73.02.02.11	76.	D	73.02.03.03	96.	B	73.02.03.07	116.	D
	77.	D		97.	B		117.	C
	78.	B		98.	C		118.	D
	79.	C		99.	C		119.	A
	80.	D		100.	C		120.	D

COURSE PRETEST ANSWER KEY

Occupational Area: ______
File Code: 73.02.00.00.A2-2
Name: ______

ANSWERS

73.02.03.08	121. B ______	73.02.04.04	141. A ______	73.02.04.08	161. A ______
	122. A ______		142. A ______		162. A ______
	123. A ______		143. B ______		163. A ______
	124. D ______		144. D ______		164. D ______
	125. A ______		145. B ______		165. A ______
3.02.04.01	126. A ______	73.02.04.05	146. A ______	73.02.04.09	166. A ______
	127. D ______		147. D ______		167. C ______
	128. D ______		148. D ______		168. D ______
	129. A ______		149. D ______		169. A ______
	130. C ______		150. C ______		170. B ______
3.02.04.02	131. D ______	73.02.04.06	151. C ______	73.02.04.10	171. C ______
	132. A ______		152. D ______		172. C ______
	133. D ______		153. C ______		173. D ______
	134. D ______		154. D ______		174. D ______
	135. C ______		155. C ______		175. B ______
73.02.04.03	136. A ______	73.02.04.07	156. B ______	73.02.04.11	176. C ______
	137. B ______		157. B ______		177. D ______
	138. C ______		158. A ______		178. A ______
	139. D ______		159. D ______		179. D ______
	140. C ______		160. D ______		180. D ______

COURSE PRETEST ANSWER KEY

Occupational Area: ____________
File Code: 73.02.00.00.A2-2
Name: ____________

ANSWERS

73.02.04.12 181. B ______
182. A ______
183. B ______
184. D ______
185. C ______
.02.04.13 186. A ______
187. C ______
188. C ______
189. D ______
190. D ______
.02.04.14 191. B ______
192. D ______
193. B ______
194. C ______
195. A ______
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239. ______
240. ______

File Code: 73.02.01.00.A2-1

Date Published: 7/7/75

Mountain-Plains Education &
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Program, Inc.

Glasgow AFB, Montana 59231

Learning Experience Guide

UNIT: PIPE AND FITTINGS

RATIONALE:

In the plumbing trade threaded pipe is not used as often now as it used to be in the past. However, it is used to some extent for making gas connections to various fixtures and appliances. Because threaded pipe has been used extensively in the past, a plumber must know how to service and repair threaded pipe. This unit will provide the information needed to develop your skills in the area of threaded pipe installation, service and repair.

PREREQUISITES:

Course: Drainage and Vent Systems

OBJECTIVE:

Identify procedures for measuring, laying out, preparing and assembling threaded pipe and pipe fittings used in supply piping systems. Identify the type and functions of threaded pipe and pipe fittings.

List material requirements, sketch, measure, layout, prepare and assemble threaded pipe and pipe fittings for supply piping systems according to given sketches and specifications following safe practices and procedures.

RESOURCES:

Printed Materials

Fixture Rough-in Book (any fixture manufacturer).
Related Information Plumbing 1. Harry Slater, Delmar Publishers, 1958.
Related Information Plumbing 2. Harry Slater, Delmar Publishers, 1959.

Equipment

Threader/Reamer/Cutter, pipe, power combination.
Tools, basic (plumber): bit, drill (set) (1/16 to 1/4 inch)
box, tool
chalk line
cutter, tubing (1/8 to 5/8 inch)
cutter, tubing (imp)
flaring tool
hacksaw

Principal Author(s):

R. Arneson/T. Bundy/T. Frisbee

RESOURCES: Equipment (cont.)

hammer, claw (16 oz.)
plier, channel lock
rule, steel (12 ft.)
screwdriver (4 in one)
square, combination (12 inch)
wrench, Allen (set)
wrench, open-end, adjustable (6 and 8 inch)
wrench, open-end/box, combination (3/8 to 3/4 inch)
wrench, pipe (12 inch)

Vice, pipe
Wrench, pipe (14, 18, 24 and 36 inch).

GENERAL INSTRUCTIONS:

This unit consists of five Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

(1) Read the first assigned Learning Activity Package (LAP).
(2) Begin and complete the first assigned LAP.
(3) Take and score the LAP test.
(4) Turn in the LAP test answer sheet.
(5) Determine the reason for any missed items on the LAP test.
(6) Proceed to and complete the next assigned LAP in the unit.
(7) Complete all required LAPs for the unit by following steps 3 through 6.
(8) Take the unit tests as described in the Unit LEG "Evaluation Procedures".
(9) Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 Pipe Nipples
.02 Angle Fitting Nomenclature, Function and Assembly
.03 Branch Fitting Nomenclature, Function and Assembly
.04 Union Nomenclature, Function and Assembly
.05 Miscellaneous Pipe Fittings

EVALUATION PROCEDURE:

When pretesting:

1. The student takes the unit multiple-choice pretest.
2. Successful completion is 4 out of 5 items for each LAP part of the pretest.
3. The student then takes a unit performance test if the unit pretest was successfully completed.
4. Satisfactory completion of the performance test is meeting the criteria listed on the performance test.

When post testing:

1. The student takes a multiple-choice unit post test and a unit performance test.
2. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

Go to the first assigned Learning Activity Package (LAP) listed on your Student Progress Record (SPR).

Student: ______________________________ File Code: 73.02.01.00.A2-2

Date: ______________________________ Date Published: 11/19/74

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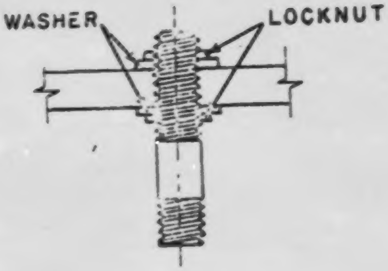
UNIT PRETEST: PIPE AND FITTINGS

73.02.01.01

1. What type of pipe nipple is depicted below?

   a. long.
   b. close.
   c. shoulder
   d. tank



2. Which of the following pipe nipples is constructed of all threads?

   a. shoulder.
   b. close.
   c. long.
   d. tank.

3. Which of the following pipe nipples are made in various graduations?

   a. tank.
   b. close.
   c. long.
   d. shoulder.

4. Pipe nipples are made in the same diameter as long pipe, from:

   a. 1/8" to 12" inside diameter.
   b. 1/2" to 16" inside diameter.
   c. 1/4" to 10" inside diameter.
   d. 3/4" to 5" inside diameter.

5. To specify a pipe nipple, which of the following information is listed first?

   a. kind (type).
   b. length.
   c. weight.
   d. inside diameter.

73.02.01.02

6. What type of pipe elbow is used only on railings?

   a. three-way elbow.
   b. lug elbow.
   c. return elbow.
   d. reducing elbow.

7. Most pipe elbows or changes are constructed to bend:

   a. 45 or 90 degrees.
   b. 30, 45, or 90 degrees.
   c. 30 or 90 degrees.
   d. 60 or 90 degrees.

8. Which of the following elbows has one outside thread and, on the opposite end, an inside thread?

   a. lug elbow.
   b. three-way elbow.
   c. street elbow.
   d. reducing elbow.

9. Identify figure #3 from the illustrations on page 3?

   a. lug elbow.
   b. return elbow.
   c. service elbow.
   d. reducing elbow.

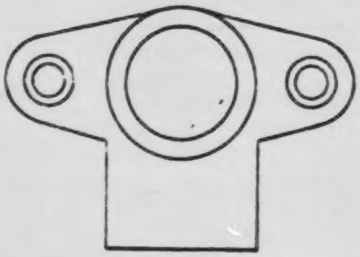
10. Which of the following identifies figure #4 on page 3?

   a. reducing elbow.
   b. street elbow.
   c. return elbow.
   d. three-way elbow.

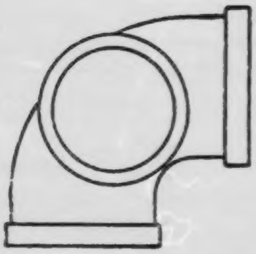
73.02.01.03

11. A pipe fitting which has four (4) outlets is called a:

   a. tee.
   b. wye.
   c. cross.
   d. X pattern elbow.

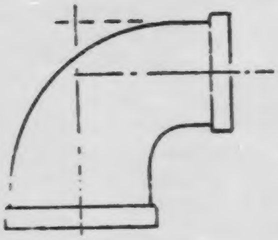


1

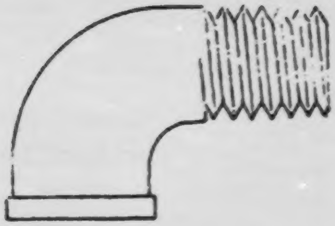


2

Diagram 5



3



4

73.02.01.03

12. The branch is at what angle to the run of a "Y"?

    a. 30 degrees.
    b. 45 degrees.
    c. 60 degrees.
    d. 72 degrees.

13. Two 3/4" branches to a hot water radiator are to be connected to a pair of 2" heating mains. Name the fittings:

    a. one 2" x 3/4" black cast iron cross.
    b. two 2" x 3/4" black cast iron reducing tees.
    c. two 2" x 3/4" galvanized iron tees.
    d. one 2" x 3/4" black iron cross.

73.02.01.03 (continued)

14. Specify a brass tee having one end 3/4", the opposite end 1 1/4", and the branch 3/4":

    a. 3/4" x 1 1/4" x 3/4" brass tee.
    b. 1 1/4" x 3/4" x 3/4" brass reducing tee.
    c. 3/4" x 3/4" x 1 1/4" brass increasing tee.
    d. 3/4" x 1 1/4" x 3/4" brass reducing tee.

15. Which of the following is mentioned last when specifying a fitting?

    a. name of the fitting.
    b. large end of the run.
    c. opposite end of the run.
    d. size of the branch.

73.02.01.04

16. For steam, air, oil and gas lines, unions are constructed of:

    a. galvanized steel.
    b. black malleable iron.
    c. galvanized iron or brass.
    d. copper or wrought iron.

17. A railroad type union is tested for a steam pressure of:

    a. 250 lbs.
    b. 100 lbs.
    c. 150 lbs.
    d. 200 lbs.

18. To tighten a union, how many wrenches are required?

    a. 1
    b. 3
    c. 4
    d. 2

19. Where on a system of pipe should unions be placed?

    a. center of pipes.
    b. close to equipment.
    c. as far away from equipment as possible.
    d. at any point.

73.02.01.04 (continued)

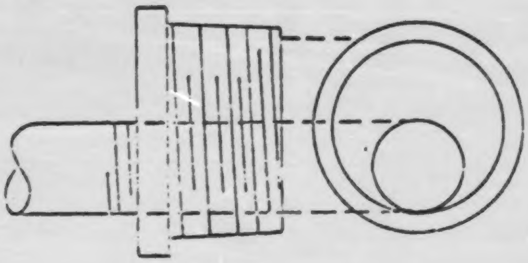
20. Which of the following materials is used for flange gaskets?

    a. asbestos.
    b. fiberglass.
    c. aluminum.
    d. sheet steel.

73.02.01.05

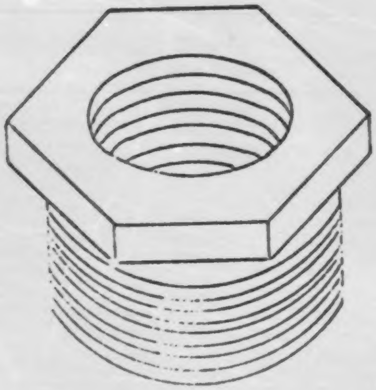
21. Identify the illustration below:

    a. eccentric bushing.
    b. hexagon bushing.
    c. eccentric reducing coupling.
    d. face bushing.



22. Identify the type of bushing illustrated below:

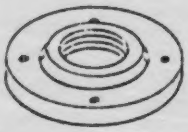
    a. eccentric reducing coupling.
    b. face.
    c. eccentric.
    d. hexagon.



73.02.01.05 (continued)

23. What type of pipe fitting is depicted below?

   a. blind flange.
   b. screwed flange.
   c. reducing flange.
   d. floor flange.

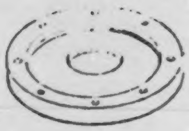


24. Which of the figures below depicts a screwed flange?

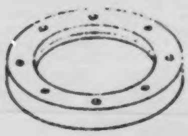
   a. #1
   b. #2
   c. #4
   d. #3

25. Identify figure #2.

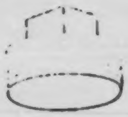
   a. floor flange.
   b. reducing flange.
   c. screwed flange.
   d. blind flangd (bottom view)



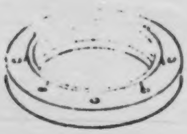
1



2



3



4

UNIT TEST ANSWER SHEET

PRETEST

Occupational Area: ______________________

File Code: 73.02.01.00.A2-2

Name: ______________________

ANSWERS

.02.01.01	1. D ______	73.02.01.05	21. A ______	41. ______
	2. B ______		22. D ______	42. ______
	3. C ______		23. D ______	43. ______
	4. A ______		24. C ______	44. ______
	5. D ______		25. D ______	45. ______
.02.01.02	6. A ______		26. ______	46. ______
	7. A ______		27. ______	47. ______
	8. C ______		28. ______	48. ______
	9. D ______		29. ______	49. ______
	10. B ______		30. ______	50. ______
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	12. B ______		32. ______	52. ______
	13. B ______		33. ______	53. ______
	14. B ______		34. ______	54. ______
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	18. D ______		38. ______	58. ______
	19. B ______		39. ______	59. ______
	20. A ______		40. ______	60. ______

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Glasgow AFB, Montana 59231

File Code: 73.02.01.01.A2-0

Date Published: 7/8/75

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Pipe Nipples

OBJECTIVES:

Identify pipe nipples by size and type.

Express the purpose of a pipe nipple.

Complete a nipple assembly that meets the specifications for installation using the appropriate tools and procedures.

EVALUATION PROCEDURE:

Successful completion of this LAP will be determined by correctly answering 8 out of 10 items on a multiple-choice test.

The pipe nipple assembly meets the given specifications.

RESOURCES:

Related Information Plumbing 1, Slater.

PROCEDURE:

1. Using Related Information Plumbing 1, do the following assignments:
    a. Read about the sizes and kinds of pipe nipples and their purpose on pages 26-27.
    b. Answer the questions and complete the indicated sketches on pages 27-28.
    c. Check answers with the answer key.
2. Have the instructor dimension the attached sketch "Pipe Nipples."
3. Go to the "long pipe" cutting and threading workstation.
4. Read the set up and procedures located at the workstation for threading short or close nipples and studs.

Principal Author(s):

R. Arneson/T. Bundy/T. Frisbee

PROCEDURE: (cont.)

5. Prepare the pipe assembly as shown on the sketch "Pipe Nipples" following directions for the specific pipe threads located at the workstations.

6. Have the instructor evaluate the pipe assembly when completed.

7. If assembly is satisfactory, disassemble the pipe assembly and return materials to storage area. Clean tools and return to proper storage, clean workstation and take the LAP test.

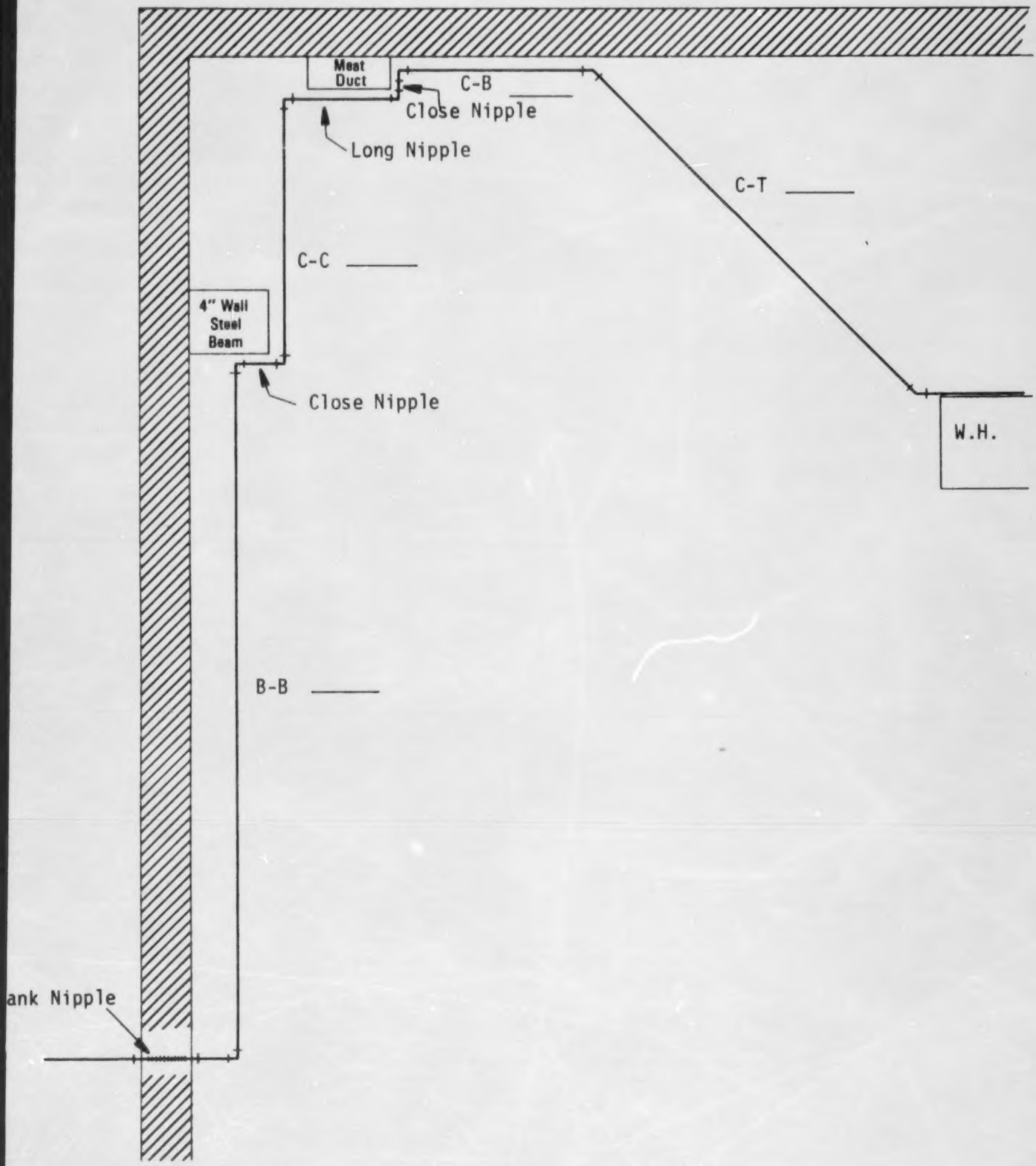
   If assembly is unsatisfactory, proceed as directed by the instructor.

8. Score the LAP test and return it.

9. If the LAP test is satisfactory, proceed to the next assigned LAP.

   If unsatisfactory, proceed as directed by the instructor.

Pipe Nipples


Meat Duct
C-B ____
Close Nipple
Long Nipple
C-T ____
C-C ____
4" Wall Steel Beam
Close Nipple
W.H.
B-B ____
ank Nipple

Student: ______________________ File Code: 73.02.01.01.A2-2

Date: ______________________ Date Published: 11/20/74

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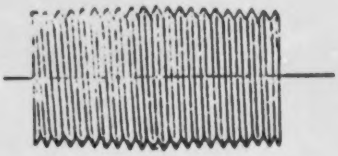
LAP TEST: PIPE NIPPLES

1. What type of pipe nipple is illustrated below?

   a. close.
   b. shoulder.
   c. long.
   d. tank.



2. Which type of pipe nipple has a short space between the threads?

   a. long.
   b. tank.
   c. close.
   d. shoulder.

3. Which of the following pipe nipples can be purchased chrome or tin-plated?

   a. galvanized steel.
   b. black steel.
   c. brass.
   d. wrought iron.

4. Which of the following pipe nipples is constructed of all threads?

   a. shoulder.
   b. close.
   c. long.
   d. tank.

5. What is the next length of a nipple longer than 4 1/2"?

   a. 4 5/8"
   b. 4 3/4"
   c. 5"
   d. 4 7/8"

6. Which of the following metals is not used for the construction of pipe nipples?

   a. brass.
   b. copper.
   c. galvanized steel.
   d. wrought iron.

7. Which of the following pipe nipples are made in various graduations?

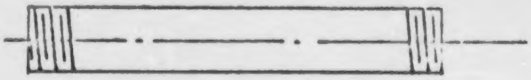
   a. tank.
   b. close.
   c. long.
   d. shoulder.

8. Pipe nipples are made in the same diameter as long pipe, from:

   a. 1/8" to 12" inside diameter.
   b. 1/2" to 16" inside diameter.
   c. 1/4" to 10" inside diameter.
   d. 3/4" to 5" inside diameter.

9. What type of pipe nipple is depicted below?

   a. long.
   b. shoulder.
   c. tank.
   d. close.



10. To specify a pipe nipple, which of the following information is listed first?

   a. kind (type).
   b. length.
   c. weight.
   d. inside diameter.

LAP TEST ANSWER KEY: PIPE NIPPLES

1. A
2. D
3. C
4. B
5. C
6. B
7. C
8. A
9. A
10. D

File Code: 73.02.01.02.A2-0

Date Published: 7/8/75

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: __________

Date: __________

PERFORMANCE ACTIVITY: Angle Fitting Nomenclature, Function and Assembly

OBJECTIVES:

Identify pipe angle fittings by size and name.

Express the purpose for various pipe angle fittings.

Complete pipe angle fitting assemblies, using appropriate tools and procedures that meet given specifications for installation.

EVALUATION PROCEDURE:

Successful completion of this LAP will be determined by correctly answering 8 out of 10 items on a multiple-choice test.

The assembly of pipe angle fittings meets specifications indicated.

RESOURCES:

Related Information Plumbing 1, Slater.

Pipe & fittings.
Pipe reamer.
Pipe threader.
Pipe vice.
Pipe wrenches.
Tape measure.

PROCEDURE:

1. Using Related Information Plumbing 1, do the following assignments:
    a. Read about pipe angle fitting names, sizes and purposes on pages 32-33.
    b. Answer the questions on pages 34-35.
    c. Check answers with the answer key.
2. Go to the threaded pipe angle fittings workstation.

Principal Author(s):

Arneson, Bundy, Frisbee

PROCEDURE: (cont.)

3. Select the box containing the assortment of various threaded pipe angle fittings.

4. Use the attached form "Fittings Identification" to record the description and function for each of the numbered fittings in the box.

5. Have the instructor evaluate the description and function.

6. If satisfactory, have the instructor dimension the attached sketch "Pipe Angle Fittings."

   If unsatisfactory, proceed as directed by the instructor.

7. Go to the "long pipe" cutting and threading workstation.

8. Prepare the pipe assembly as shown on the sketch "Pipe Angle Fittings."

9. When the pipe assembly is finished, have the instructor evaluate it.

10. If the pipe assembly is satisfactory, disassemble and return parts to the storage area, clean tools and return them to proper storage, clean the workstation and take the LAP test.

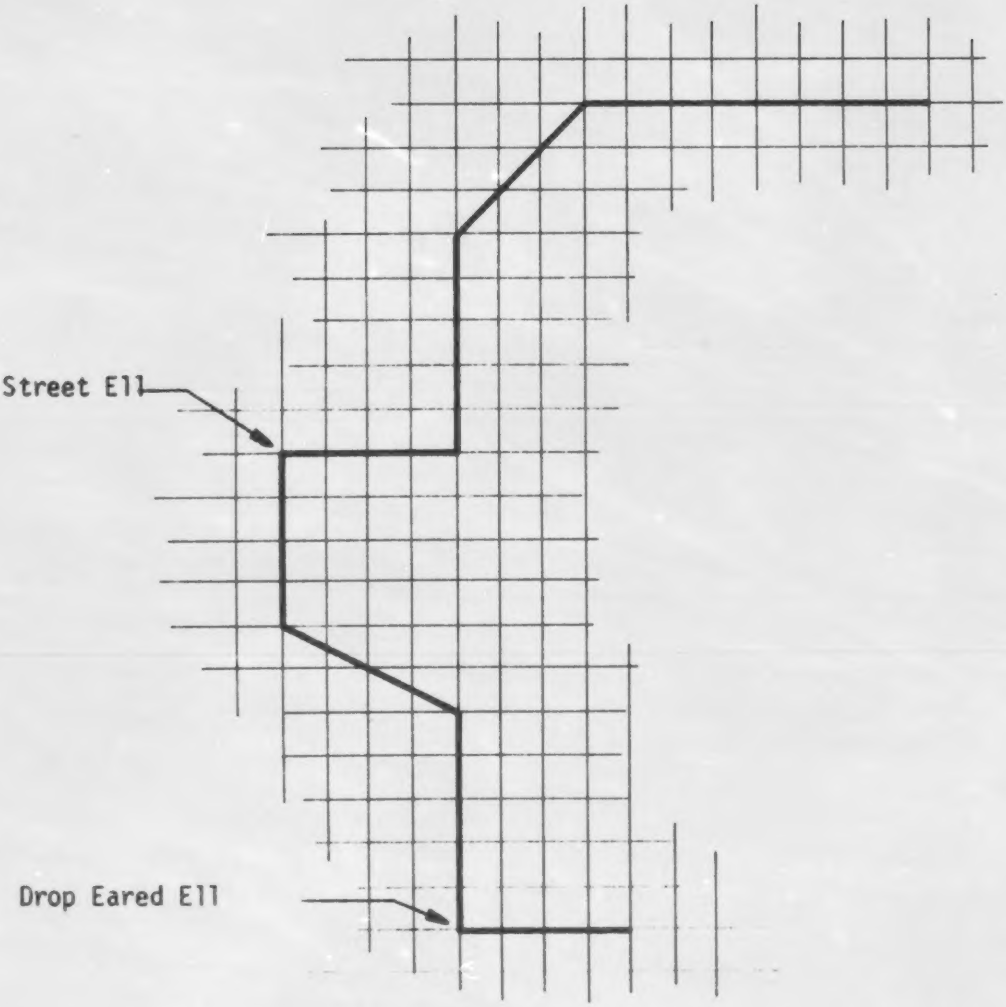
    If the pipe assembly is unsatisfactory, proceed as directed by the instructor.

11. Score the LAP test and return it.

12. If the LAP test is satisfactory, begin the next assigned LAP.

    If the LAP test is not satisfactory, proceed as directed by the instructor.

Pipe Angle Fittings


Street Ell
Drop Eared Ell

Center to center measure scale - each block represents 2"

73.02.01.02.A2-0

FITTINGS IDENTIFICATION

Directions: Select a fitting from the assortment. After the number below that matches the fitting number write the description and function.

Work Station Number________________________ Box Number________________________________

FITTING NUMBER	DESCRIPTION (Size, Weight, Type, Etc.)	FUNCTION (For What Used)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Student: ____________________ File Code: 73.02.01.02.A2-2

Date: ____________________ Date Published: 11/20/74

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LAP TEST: ANGLE FITTING NOMENCLATURE, FUNCTION AND ASSEMBLY

1. What type of pipe elbow is used only on railings?
   - a. three-way elbow.
   - b. lug elbow.
   - c. return elbow.
   - d. reducing elbow.

2. Most pipe elbows or changes are constructed to bend:
   - a. 45 or 90 degrees.
   - b. 30, 45, or 90 degrees.
   - c. 30 or 90 degrees.
   - d. 60 or 90 degrees.

3. What type of iron elbow is used on air, oil lines or railings?
   - a. galvanized iron.
   - b. black iron.
   - c. black cast iron.
   - d. wrought iron.

4. What type of elbow is used on pipe coils?
   - a. return elbow.
   - b. lug elbow.
   - c. service elbow.
   - d. reducing elbow.

5. What type of iron elbow is used on water lines or outside piping to prevent rusting?
   - a. black iron.
   - b. black cast iron.
   - c. wrought iron.
   - d. galvanized iron.

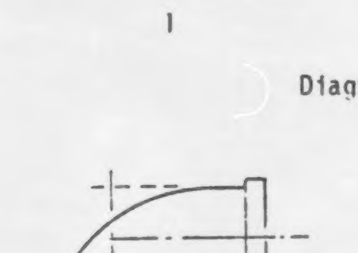
6. Which of the following elbows is made for close work as it is shorter than a close nipple and an elbow?
   - a. lug elbow.
   - b. three-way elbow.
   - c. service elbow.
   - d. reducing elbow.

7. Which of the following types of iron elbows is made with a heavy bead and is used on heating systems?
   - a. galvanized iron.
   - b. wrought iron.
   - c. black cast iron.
   - d. black iron.

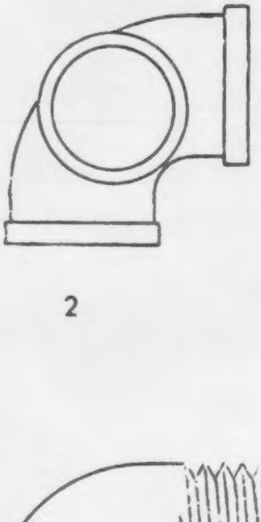
8. Identify figure #1.
   - a. return elbow.
   - b. lug elbow.
   - c. service elbow.
   - d. three-way elbow.

9. Identify figure #3.
   - a. lug elbow.
   - b. return elbow.
   - c. service elbow.
   - d. reducing elbow.

10. Which of the following identifies figure #4.
   - a. reducing elbow.
   - b. service elbow.
   - c. return elbow.
   - d. three-way elbow.

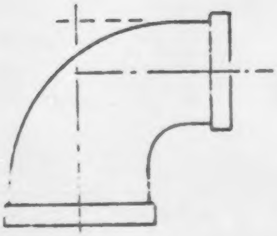


1

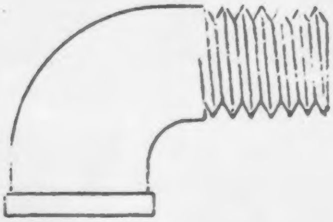


2

Diagram 5



3



4

LAP TEST ANSWER KEY: ANGLE FITTING NOMENCLATURE, FUNCTION AND ASSEMBLY

1. A
2. A
3. B
4. A
5. D
6. C
7. C
8. B
9. D
10. B

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File Code: 73.02.01.03.A2-0

Date Published: 7/8/75

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Branch Fitting Nomenclature, Function and Assembly

OBJECTIVES:

Identify pipe branch fittings by size and name.

Express the purpose for various pipe branch fittings.

Complete pipe branch fitting assemblies that meet the specifications for installation using appropriate tools and equipment.

EVAULATION PROCEDURE:

The successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

The pipe branch fitting assembly meets the given specifications.

RESOURCES:

Related Information Plumbing 1, Slater.

Pipe & fittings.
Pipe cutter/reamer/threader.
Pipe vice.
Pipe wrench.
Tape measure.

PROCEDURE:

1. Using Related Information Plumbing 1, do the following assignments:
    a. Read about pipe branch fitting names, sizes and purposes on pages 36-37.

       KEY POINT: Note the method of expressing the fitting specifications.
    b. Answer the questions on pages 38-39.
    c. Check answers with the answer key.

Principal Author(s):

R. Arneson, T. Bundy, T. Frisbee

PROCEDURE: (cont.)

2. Go to the threaded pipe branch fitting workstation.

3. Select the box of assorted threaded pipe branch fittings.

4. Using the attached form "Fittings Identification," record the description and function for each of the numbered threaded pipe branch fittings in the box.

5. Check answers with the answer key.

6. If satisfactory, have an instructor dimension the attached sketch "Pipe Branch Fittings."

   If unsatisfactory, proceed as directed by the instructor.

7. Go to the "long pipe" cutting and threading workstation and prepare the pipe assembly as shown on the sketch "Pipe Branch Fittings."

8. After completing the pipe assembly, have the instructor evaluate it.

9. If the pipe assembly is satisfactory, disassemble it and return the parts to the storage area, clean tools and return them to proper storage, clean the workstation and take the LAP test.

   If the pipe assembly is not satisfactory, proceed as directed by the instructor.

10. Score the LAP test and return it.

11. If the LAP test is satisfactory, begin the next assigned LAP.

    If the LAP test is unsatisfactory, proceed as directed by the instructor.

73.02.01.03.A2-0

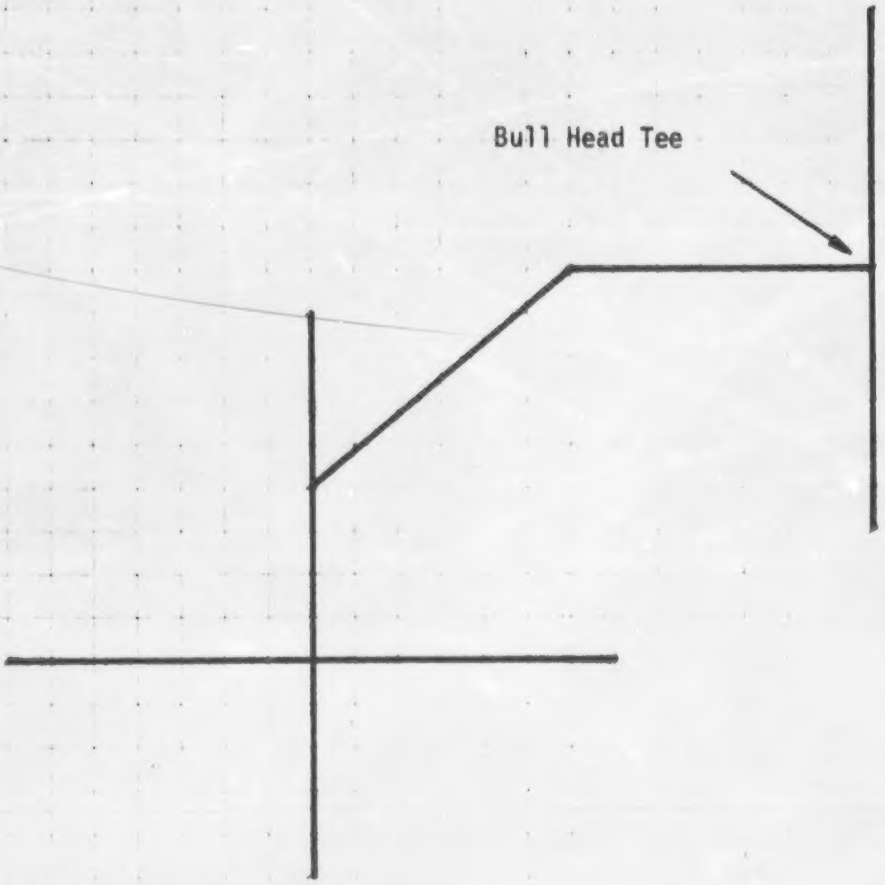
FITTINGS IDENTIFICATION

Directions: Select a fitting from the assortment. After the number below that matches the fitting number write the description and function.

Work Station Number____________________ Box Number__________________________

FITTING NUMBER	DESCRIPTION (Size, Weight, Type, Etc.)	FUNCTION (For What Used)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Pipe Branch Fittings



NOTE: Student should label properly each fitting used in his assembly on the sketch.

Scale 2" = one square.
Measurements center to center.

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LAP TEST: BRANCH FITTING NOMENCLATURE, FUNCTION & ASSEMBLY

1. How are the specifications for a tee with three different sized outlets read?

   a. large size of the run first, small size of the run, size of the branch, and the name of the fitting.
   b. size of the branch first, small size of the run, large size of the run, and the name of the fitting.
   c. the name of the fitting, size of the branch, large size of the run, and the small size of the run.
   d. the size of the branch first, the name of the fitting, large size of the run, and the small size of the run.

2. "Y's" have a branch on:

   a. 60 degrees.
   b. 30 degrees.
   c. 45 degrees.
   d. 90 degrees.

3. A tee having a branch larger than the run is called a:

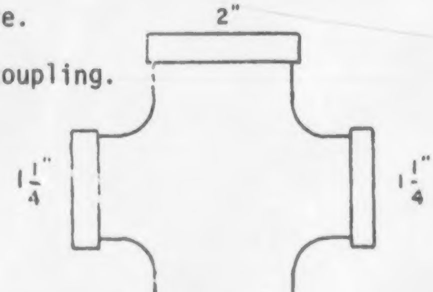
   a. enveloping tee.
   b. standard increasing tee.
   c. bull head tee.
   d. straight tee.

4. A 1 1/2" branch is to be connected to a 2" water main. What fitting is used?

   a. a 2" x 1 1/2" galvanized reducing tee.
   b. a 2" x 1 1/2" galvanized straight tee.
   c. a 1 1/2" x 2" galvanized increasing tee.
   d. a 2" x 1 1/2" black cast iron cross.

5. Specify the galvanized malleable fitting shown below:

   a. a 2" x 1 1/4" black cast iron cross.
   b. a 2" x 1 1/4" x 2" x 1 1/4" cast iron wye.
   c. a 2" x 2" black cast iron tee.
   d. a 2" x 1 1/4" black cast iron reducing coupling.



6. How many outlets have a tee and what angle are they to one another?

   a. 3 outlets; 45 degrees between each.
   b. 4 outlets; 45 degrees between each.
   c. 2 outlets; 180 degrees between each.
   d. 3 outlets; 90 degrees between each.

7. The branch is at what angle to the run of a "Y"?

   a. 30 degrees.
   b. 45 degrees.
   c. 60 degrees.
   d. 72 degrees.

8. Two 3/4" branches to a hot water radiator are to be connected to a pair of 2" heating mains. Name the fittings:

   a. one 2" x 3/4" black cast iron cross.
   b. two 2" x 3/4" black cast iron reducing tees.
   c. two 2" x 3/4" galvanized iron tees.
   d. one 2" x 3/4" black iron cross.

9. List a branch fitting to join a 1 1/4" brass pipe to a 1 1/2" brass water main which carries very high pressure:

   a. a 1 1/2" x 1 1/4" extra heavy brass reducing coupling.
   b. a 1 1/4" x 1 1/2" heavy brass coupling.
   c. a 1 1/2" x 1 1/4" medium brass reducing coupling.
   d. a 1 1/4" x 1 1/2" heavy brass reducing coupling.

10. Which of the following is mentioned last when specifying a fitting?

    a. name of the fitting.
    b. large end of the run.
    c. opposite end of the run.
    d. size of the branch.

LAP TEST ANSWER KEY: BRANCH FITTING NOMENCLATURE, FUNCTION & ASSEMBLY

1. A
2. C
3. C
4. A
5. A
6. D
7. B
8. B
9. A
10. A

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Date Published: 7/8/75

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student:

Date:

PERFORMANCE ACTIVITY: Union Nomenclature, Function and Assembly

OBJECTIVES:

Express the purpose for pipe unions.

Identify pipe unions by size and type.

Complete pipe union assemblies that meet the specifications for installation using appropriate tools and procedures.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

The pipe union assembly meets given specifications.

RESOURCES:

Related Information Plumbing 1, Slater.

Pipe & union.
Pipe threader/cutter/reamer.
Pipe wrench.
Tape measure.

PROCEDURE:

1. Using Related Information Plumbing 1, do the following assignments:
    a. Read about pipe union on pages 43-44.
    b. Answer questions on pages 44-45.
    c. Check answers with the answer key.
    d. Read about union elbows on page 46.
    e. Answer questions on pages 46-47.

Principal Author(s):

Arneson, Bundy, Frisbee

PROCEDURE: (cont.)

f. Check answers with the answer key.

g. Read about flange unions on page 48.

h. Answer questions and make requested sketch on pages 49-50.

i. Check answers with the answer key.

2. Go to the workstation.

3. Obtain the box of assorted unions.

4. Using the attached form "Fittings Identification," record the description and function for each of the numbered pipe unions in the box.

5. Check answers with the answer key.

6. If satisfactory, have the instructor dimension the attached sketch "Pipe Union Assembly."

   If unsatisfactory, proceed as directed by the instructor.

7. Go to the long pipe cutting and threading workstation and prepare the pipe assembly shown on the sketch "Pipe Union Assembly."

8. After completion of the pipe assembly, have the instructor evaluate it.

9. If the pipe assembly is satisfactory, dissassemble it and return the parts to the storage area, clean tools and return them to proper storage, clean the workstation and take the LAP test.

   If the pipe assembly is unsatisfactory, proceed as directed by the instructor.

10. Score the LAP test and return it.

11. If the LAP test is satisfactory, begin the next assigned LAP.

    If the LAP test is unsatisfactory, proceed as the instructor directs.

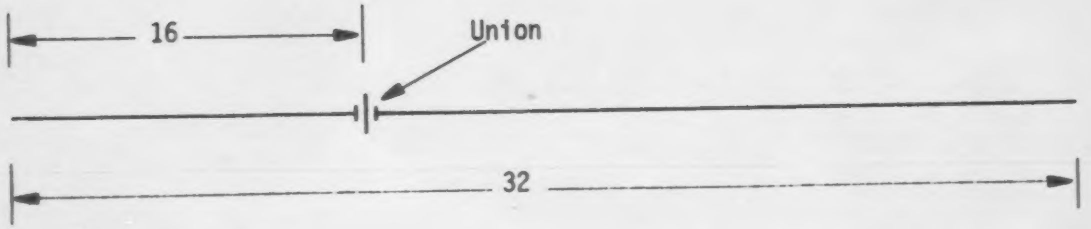
FITTINGS IDENTIFICATION

Directions: Select a fitting from the assortment. After the number below that matches the fitting number write the description and function.

Work Station Number____________________ Box Number___________________________

FITTING NUMBER	DESCRIPTION (Size, Weight, Type, Etc.)	FUNCTION (For What Used)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Pipe Union Assembly



1. Cut a piece of pipe to the indicated length.
2. Have the instructor check before you complete the next step.
3. Cut the length of pipe and install the union.

KEY POINT: When assembled, the union must be tight and the pipe and union assembly must be 32" long.

Student: ____________________ File Code: 73.02.01.04.A2-2

Date: ____________________ Date Published: 11/20/74

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LAP TEST: UNION NOMENCLATURE, FUNCTION AND ASSEMBLY

1. A union consists of how many parts?

   a. 4
   b. 3
   c. 2
   d. 5

2. The part of a union which draws the two pieces on the pipes together is called a:

   a. lock nut.
   b. securing nut.
   c. collar.
   d. control adjustment.

3. Unions are made in sizes from:

   a. 1/2" to 6"
   b. 1/4" to 4"
   c. 3/4" to 8"
   d. 1/8" to 3"-4"

4. Unions are constructed in different weights to withstand:

   a. 100-150 lbs. of pressure per square inch.
   b. 150-250 lbs. of pressure per square inch.
   c. 50-75 lbs. of pressure per square inch.
   d. 200-400 lbs. of pressure per square inch.

5. For water lines, unions are made of:

   a. black cast iron.
   b. galvanized iron or brass.
   c. wrought iron.
   d. galvanized steel or copper.

6. A railroad type union is tested for a steam pressure of:

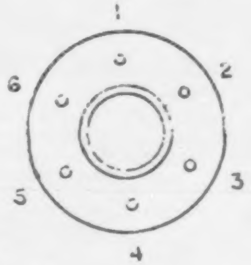
   a. 250 lbs.
   b. 100 lbs.
   c. 150 lbs.
   d. 200 lbs.

7. Where on a system of pipes should unions be placed?

   a. center of pipes.
   b. close to equipment.
   c. as far away from equipment as possible.
   d. at any point.

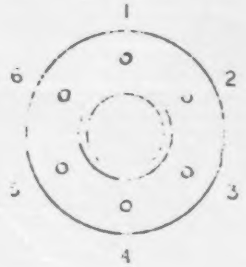
8. Name the order in which the bolts on the flange union provided below should be tightened:

   a. 1, 4, 2, 5, 3, 6
   b. 6, 5, 4, 3, 2, 1
   c. 1, 2, 3, 4, 5, 6
   d. 2, 4, 6, 1, 3, 5



9. What is the angle between the holes in the flange union below?

   a. 90 degrees.
   b. 30 degrees.
   c. 45 degrees.
   d. 60 degrees.



10. Which of the following materials is used for flange gaskets?

   a. asbestos.
   b. fiberglass.
   c. aluminum.
   d. sheet steel.

LAP TEST ANSWER KEY: UNION NOMENCLATURE, FUNCTION AND ASSEMBLY

1. B
2. C
3. D
4. B
5. B
6. A
7. B
8. A
9. D
10. A

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Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Miscellaneous Pipe Fittings

OBJECTIVES:

Identify the types and sizes of various pipe fittings that are classified outside the categories of angle fittings, branch fittings and unions (like bushings, couplings and plugs).

Express the purpose for these miscellaneous fittings and recognize when and where they are used.

Complete miscellaneous pipe fitting assemblies that meet the specification for installation using appropriate tools and procedures.

EVALUATION PROCEDURE:

Successful completion of this LAP is by correctly answering 8 out of 10 items on a multiple-choice test.

The assembled miscellaneous pipe fittings that conform with given specifications.

RESOURCES:

Related Information Plumbing 1, Slater.

Pipe & miscellaneous.
Pipe cutter/threader/reamer.
Pipe fittings.
Pipe wrench.
Tape measure.

PROCEDURE:

1. Using Related Information Plumbing 1, do the following assignments:
    a. Read about threaded pipe bushings and couplings on pages 40-41.
    b. Answer the questions and make the requested sketch on pages 41-42.
    c. Check the answers with the answer key.

Principal Author(s):

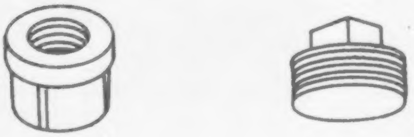
Arneson, Bundy, Frisbee

PROCEDURE: (cont.)

2. Read the following:

In Figure 1 are illustrated some other miscellaneous threaded pipe fittings.

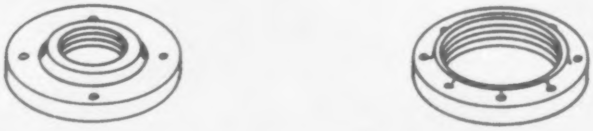
FIGURE 1: PIPE CAP AND PIPE PLUG



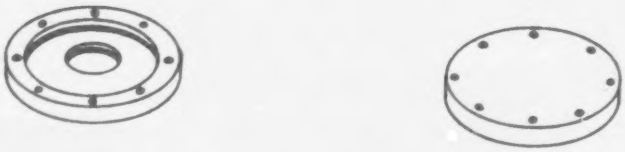
Pipe Cap Pipe Plug

Pipe plugs for threaded pipe are threaded externally. The plug is used to close and seal an opening in a pipe fitting. The plug usually has a square head to screw and tighten into the fitting. Pipe caps are used to close the end of a threaded pipe. The cap is threaded internally for this purpose. Floor flanges are used to anchor and attach pipe to walk and floors. Several types of flanges are available as shown in Figure 2.

FIGURE 2: FLANGES



Floor Flange Screwed Flange



Reducing Flange Blind Flange

The blind flanges are used to cap a pipe at the floor or wall. Dimensions for threaded pipe fittings are by the pipe size that it joins.

PROCEDURE: (cont.)

3. Obtain the box of miscellaneous threaded pipe fittings.
4. On the attached form "Fittings Identification," describe and give the function of each of the numbered fittings found in the box.
5. Check answers with the answer key.
6. If the descriptions and functions are satisfactory, make the assembly shown on the attached sketch "Threaded Miscellaneous Pipe Fittings."

   If the description and functions are unsatisfactory, proceed as directed by the instructor.
7. When the assembly is completed, have it evaluated by the instructor.
8. If the assembly is satisfactory, clean and return tools and take the LAP test.

   If the assembly is unsatisfactory, proceed as the instructor advises.
9. Score the LAP test and return it.
10. If the LAP test is satisfactory, begin the next assigned LAP.

    If the LAP test is not satisfactory, proceed as directed by the instructor.

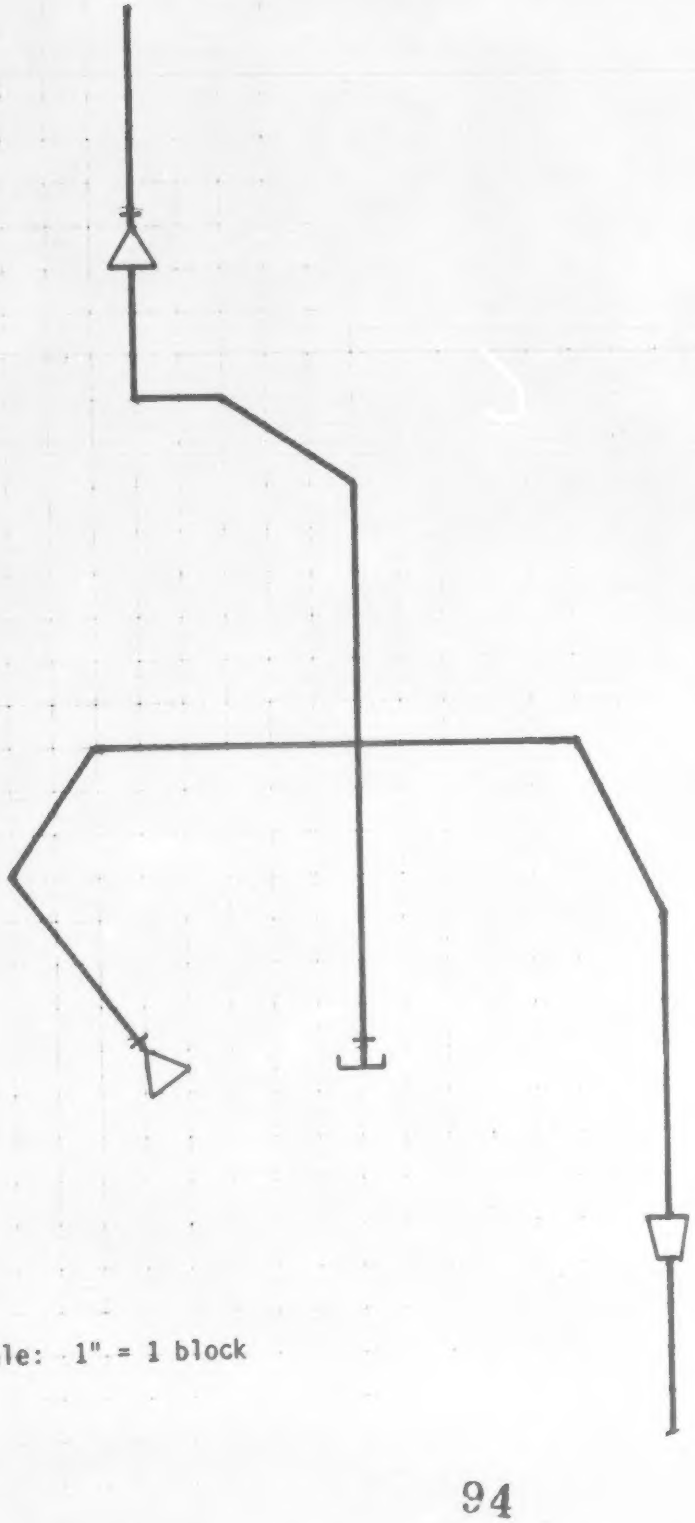
FITTINGS IDENTIFICATION

Directions: Select a fitting from the assortment. After the number below that matches the fitting number write the description and function.

Work Station Number____________________ Box Number__________________________

FITTING NUMBER	DESCRIPTION (Size, Weight, Type, Etc.)	FUNCTION (For What Used)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Threaded Miscellaneous Pipe Fittings



Scale: 1" = 1 block

Student: ____________________ File Code: 73.02.01.05.A2-2

Date: ____________________ Date Published: 1/28/75

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LAP TEST: MISCELLANEOUS PIPE FITTINGS

1. Which of the following bushings are used in heating, oil, gas or air lines?

   a. galvanized malleable iron.
   b. brass.
   c. black cast iron.
   d. galvanized steel.

2. It is desired to connect a 1 1/2" oil pipe to a tank with a 2" tapping. What fitting should be specified?

   a. a 2" x 1 1/2" copper bushing.
   b. a 1 1/2" x 2" black cast iron bushing.
   c. a 2" x 1 1/2" galvanized bushing.
   d. a 2" x 1 1/2" black iron bushing.

3. Specify a fitting that will reduce a 3" pipe to a 2 1/2" pipe:

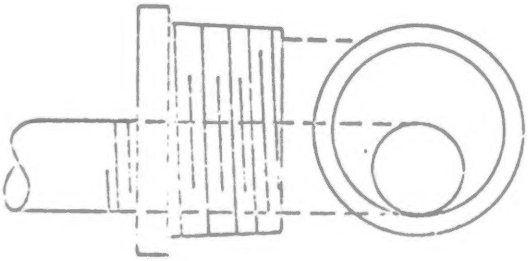
   a. a 3" x 2 1/2" black cast reducing coupling.
   b. a 3" x 2 1/2" galvanized iron bushing.
   c. a 2 1/2" x 3" black iron coupling.
   d. a 3" x 2 1/2" brass reducing coupling.

4. What fitting could be used to reduce a steam main which would serve the same purpose as an eccentric bushing?

   a. off-center increasing coupling.
   b. hexagon bushing.
   c. eccentric reducing coupling.
   d. face bushing.

5. Identify the illustration below:

   a. eccentric bushing.
   b. hexagon bushing.
   c. eccentric reducing coupling.
   d. face bushing.

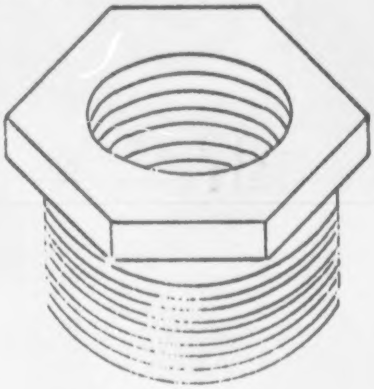


6. What type of bushings should be used in water lines or outside piping where rusting is possible?

   a. brass bushings.
   b. black cast iron bushings.
   c. copper bushings.
   d. steel bushings.

7. Identify the type of bushing illustrated below:

   a. eccentric reducing coupling.
   b. face.
   c. eccentric.
   d. hexagon.

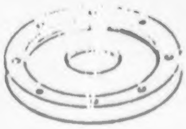


8. Identify figure #1.

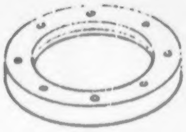
   a. pipe cap.
   b. blind flange.
   c. floor flange.
   d. reducing flange.

9. Which of the following identifies figure #3?

   a. reducing flange.
   b. pipe cap.
   c. blind flange.
   d. pipe plug.



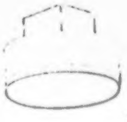
1



2

10. Identify figure #2:

   a. floor flange.
   b. reducing flange.
   c. screwed flange.
   d. blind flange (bottom view).



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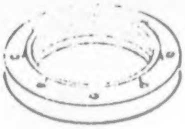

4

LAP TEST ANSWER KEY: MISCELLANEOUS PIPE FITTINGS

1. C
2. C
3. A
4. C
5. A
6. A
7. D
8. D
9. D
10. D

Student: ______________________ **File Code:** 73.02.01.00.B2-2

Date: ______________________ **Date Published:** 11/20/74

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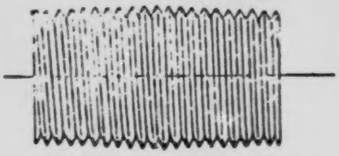
UNIT POST TEST: PIPE AND FITTINGS

73.02.01.01

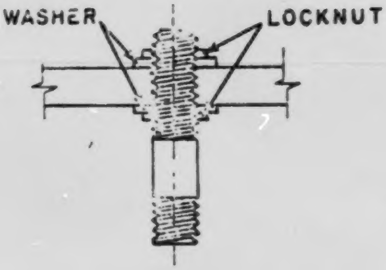
1. What type of pipe nipple is illustrated below?

   a. close
   b. shoulder.
   c. long.
   d. tank.



2. What type of pipe nipple is depicted below?

   a. long.
   b. close.
   c. shoulder.
   d. tank.

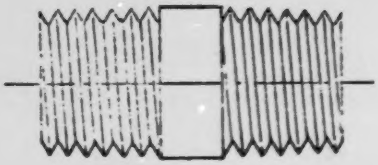


3. Which of the following pipe nipples can be purchased chrome or tin-plated?

   a. galvanized steel.
   b. black steel.
   c. brass.
   d. wrought iron.

4. What type of pipe nipple is illustrated below?

   a. tank.
   b. close
   c. long.
   d. shoulder



73.02.01.01 (continued)

5. To specify a pipe nipple, which of the following information is not listed?

   a. kind (type).
   b. length.
   c. weight.
   d. inside diameter.

73.02.01.02

6. In what sizes (inside diameter) are pipe elbows available?

   a. 1/16" - 14"
   b. 1/4" - 6"
   c. 3/8" - 10"
   d. 1/8" - 8"

7. In which of the following weights are brass fittings made?

   a. medium and extra heavy.
   b. medium and heavy.
   c. standard and extra heavy.
   d. standard and heavy.

8. Elbows are usually made of:

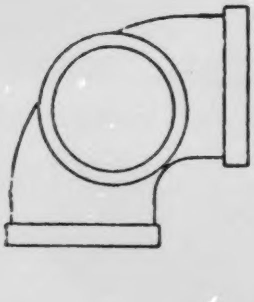
   a. malleable iron.
   b. galvanized steel.
   c. copper.
   d. brass.

9. Which of the following elbows has one outside thread and, on the opposite end, an inside thread?

   a. lug elbow.
   b. three-way elbow.
   c. service elbow.
   d. reducing elbow.

10. Which of the types of elbows correctly identifies the diagram below?

   a. lug elbow.
   b. three-way elbow.
   c. reducing elbow.
   d. return elbow.



73.02.01.03

11. A tee which has all three (3) outlets the same size is known as a:

    a. regular tee.
    b. standard tee.
    c. straight tee.
    d. standard 3 outlet tee.

12. A pipe fitting which has four (4) outlets is called a:

    a. tee.
    b. wye.
    c. cross.
    d. X pattern elbow.

13. Specify a brass tee having one end 3/4", the opposite end 1 1/4", and the branch 3/4":

    a. a 3/4" x 1 1/4" x 3/4" brass tee.
    b. a 1 1/4" x 3/4" x 3/4" brass reducing tee.
    c. a 3/4" x 3/4" x 1 1/4" brass increasing tee.
    d. a 3/4" x 1 1/4" x 3/4" brass reducing tee.

14. Which of the following is mentioned last when specifying a fitting?

    a. name of the fitting.
    b. large end of the run.
    c. opposite end of the run.
    d. size of the branch.

15. Extra heavy brass elbows are available in which of the following sizes?

    a. 1/8" - 4"
    b. 1/2" - 6"
    c. 1/4" - 8"
    d. 3/8" - 5"

73.02.01.04

16. Unions are galvanized to prevent:

    a. leaks.
    b. rusting.
    c. fluctuations in pressure.
    d. the threads from stripping.

73.02.01.04 (continued)

17. For steam, air, oil and gas lines, unions are constructed of:

    a. galvanized steel.
    b. black malleable iron.
    c. galvanized iron or brass.
    d. copper or wrought iron.

18. In specifying the size of a boiler union elbow, which of the following information is given first?

    a. tube size.
    b. outside end.
    c. supply end.
    d. name of fitting.

19. A boiler union elbow consists of how many pieces?

    a. 4
    b. 2
    c. 1
    d. 3

20. Why shouldn't a black flange union be used on a water line?

    a. it is subject to leaks.
    b. it will rust.
    c. it will not withstand the fluid pressure required.
    d. it doesn't come in large enough sizes.

73.02.01.05

21. What are the three types of bushings?

    a. face, eccentric and off-center.
    b. octagon, square, and hexagon.
    c. off-center, square, and face.
    d. hexagon, face, and eccentric.

22. Reducing couplings are made in sizes from:

    a. 1" x 3/4" to 5" x 3 3/4".
    b. 1/8" x 1/2" to 6" x 2".
    c. 1/4" x 1/8" to 4" x 3 1/2".
    d. 1/2" x 1/2" to 4" x 4".

73.02.01.05 (continued)

23. When reducing a 1 1/4" branch of a tee to 1", what fitting should be used to do the neatest possible job?

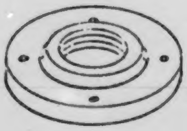
    a. a 1" x 1 1/4" eccentric bushing.
    b. a 1 1/4" x 1" face bushing.
    c. a 1 1/4" x 1" hexagon bushing.
    d. a 1 1/4" x 1" square bushing.

24. A heating boiler has 4" outlets. 2 1/2" mains are to be connected. Which of the following fittings should be used?

    a. 2 1/2" x 4" copper hexagon bushings.
    b. 2 1/2" x 4" galvanized malleable iron face bushings.
    c. 4" x 2 1/2" brass eccentric reducing couplings.
    d. 4" x 2 1/2" black cast hexagon bushings.

25. What type of pipe fitting is depicted below?

    a. blind flange.
    b. screwed flange.
    c. reducing flange.
    d. floor flange.



UNIT TEST ANSWER SHEET

POST TEST

Occupational Area: ____________________

File Code: 73.02.01.00.B2-2

Name: ____________________

ANSWERS

73.02.01.01
1. A ______
2. D ______
3. C ______
4. D ______
5. C ______

73.02.01.02
6. D ______
7. C ______
8. A ______
9. C ______
10. B ______

73.02.01.03
11. C ______
12. C ______
13. B ______
14. A ______
15. A ______

73.02.01.04
16. B ______
17. B ______
18. C ______
19. D ______
20. B ______

73.02.01.05
21. D ______
22. C ______
23. B ______
24. D ______
25. D ______
26. ______
27. ______
28. ______
29. ______
30. ______
31. ______
32. ______
33. ______
34. ______
35. ______
36. ______
37. ______
38. ______
39. ______
40. ______

41. ______
42. ______
43. ______
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45. ______
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47. ______
48. ______
49. ______
50. ______
51. ______
52. ______
53. ______
54. ______
55. ______
56. ______
57. ______
58. ______
59. ______
60. ______

Student: ______________________ File Code: 73.02.01.00.A1-5

Date: ______________________ Date Published: 11/13/74

Family Pay Number: __________ Sex: M F (Circle 1)

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UNIT PERFORMANCE TEST: PIPE AND FITTINGS

OBJECTIVE 1:

Given a floor plan, draw a complete water supply system for a typical bathroom in a residential dwelling using threaded pipe.

OBJECTIVE 2:

Given a floor plan, lay out a complete water supply system for a typical bathroom in a residential dwelling using threaded pipe.

OBJECTIVE 3:

Given a floor plan, assemble a complete water supply system for a typical bathroom in a residential dwelling using threaded pipe.

TASK:

Having a floor plan, the student will plan, lay out, and assemble a supply system for a bathroom in a typical residence, using threaded pipe.

ASSIGNMENT:

CONDITIONS:

The student will be supplied with the necessary tools and equipment to complete the job. He may use any reference material available. No assistance may be obtained from other students or instructors.

RESOURCES:

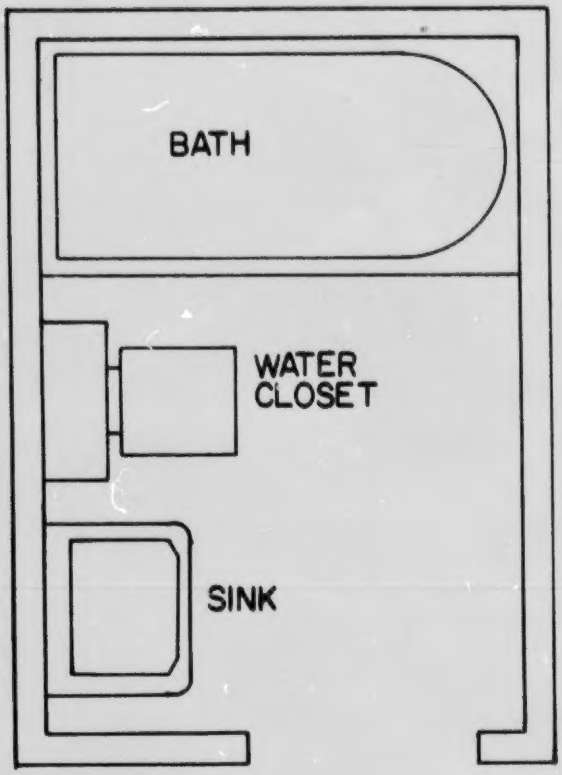
1. Printed Materials:

   Montana State Plumbing Code
   Related information: Plumbing I and II, Harry Slater
   Audels Plumbers and Pipe Fitters library materials

2. Equipment:

   Typical hand tools (hammer, screwdriver, pliers, etc.)
   Pipe threader
   Pipe cutter
   Soil pipe cutter
   Lead Pot
   Lead furnace
   Ladel
   Caulking irons
   Rulers, tapes, calipers
   Plastic pipe cutter
   Galvanized pipe and fittings

ASSIGNMENT SHEET


BATH
WATER CLOSET
SINK

Student: ____________________ File Code: 73.02.01.00.A1-5

Date: ____________________ Date Published: ____________________

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Glasgow AFB, Montana 59231

Family Pay Number: __________ Sex: M F (Circle 1)

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Drawing is neat.		
Criterion: It is readable.		
2. Drawing is accurate.		
Criterion: a. Conforms to State Plumbing Code.		
b. Conforms to the floor plan.		
Objective 2:		
3. Measurements are accurate.		
Criterion: To ± ¼" of the plan.		
4. Pipe and fittings are appropriate.		
Criterion: State Plumbing Code.		
Objective 3:		
5. Uses appropriate tools, equipment and procedures.		
Criterion: a. Manufacturer's directions.		
b. Hand Tools, Westinghouse Learning Corp.		

(Checklist continued)

	CRITERION	
	Met	Not Met
6. Follows safe practices and procedures.		
Criterion: OSHA.		
7. Assembly is neat and presentable.		
Criterion: a. State Plumbing Code.		
b. Plumb and square to ± ¼" where appropriate		
c. Meets Building Code.		
8. System functions properly.		
Criterion: No leaks by water or air test to 80 pounds.		
9. Completes the job in a reasonable amount of time.		
Criterion: 8 hours.		
Student must complete 7/8 of all line items, except number 8		
must be satisfactory to pass test.		

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Date Published: 7/8/75

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Learning Experience Guide

UNIT: COLD WATER SUPPLY

RATIONALE:

Copper tubing, fittings and valves are extensively used in modern plumbing systems. Therefore, the plumber needs skills to install various types and sizes of copper tubing in a plumbing system. The plumber must also understand the relationship and effects of pressure on a plumbing system. An understanding of water pressure is essential to the plumber if he is to properly install a copper plumbing system. A plumber prepares the setup for water meters and strainers; thus, this requires the plumber's understanding of how to install and service water meters and strainers.

PREREQUISITES:

Course: Drainage and Vent Systems

OBJECTIVES:

Identify the assembly procedures for copper pipe, fittings and valves for supply piping.

Perform the material determination, layout, preparation and assembly of copper pipe, fittings and valves for supply piping according to specifications following safe practices.

Identify the effects and characteristics of water and service piping related to plumbing.

Determine and calculate water pressures for given situtations.

RESOURCES:

Printed Materials

Plumbers and Pipe Fitters Library: Drainage, Fittings, Fixtures, Volume 2. Jules Oravetz, Sr., Theodore Audel and Company, 1967.
Related Information Plumbing 1. Harry Slater, Delmar Publishers, 1958.
Related Information Plumbing 2. Harry Slater, Delmar Publishers, 1959.

Equipment

Brushes, fitting, cleaner (assorted).
Swaging tool.

Principal Author(s):

Arneson, Bundy, Frisbee

RESOURCES: Equipment (Cont.)

Tools, basic (plumber): bit, drill (set) (1/16 to 1/4 inch)
box, tool
chalk line
cutter, tubing (1/8 to 5/8 inch)
cutter, tubing (imp)
flaring tool
hacksaw
hammer, claw (16 oz.)
plier, channel lock
rule, steel (12 ft.)
screwdriver (4 in one)
square, combination (12 inch)
wrench, Allen (set)
wrench, open-end, adjustable (6 and 8 inch)
wrench, open-end/box, combination (3/8 to 3/4 inch)
wrench, pipe (12 inch)
Torch and tank, Presto Lite or equivalent.
Wrench, pipe (14, 18, 24 and 36 inch).

GENERAL INSTRUCTIONS:

This unit consists of twelve Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

(1) Read the first assigned Learning Activity Package (LAP).
(2) Begin and complete the first assigned LAP.
(3) Take and score the LAP test.
(4) Turn in the LAP test answer sheet.
(5) Determine the reason for any missed items on the LAP test.
(6) Proceed to and complete the next assigned LAP in the unit.
(7) Complete all required LAPs for the unit by following steps 3 through 6.
(8) In this Unit, there are some LAPs that have tests combined with other LAP tests. These combined tests are taken after completing the last LAP covered by the test.
(9) Take the unit tests as described in the Unit LEG "Evaluation Procedures".
(10) Proceed to the next assigned unit.

Be sure to use safe practices and procedures in all your work.

PERFORMANCE ACTIVITIES:

.01 Copper Pipe Nomenclature and Cutting
.02 Swagging Copper Tubing
.03 Sweating Copper Tubing
.04 Copper Sweat Angle Fittings
.05 Copper Sweat Branch Fitting
.06 Miscellaneous Copper Sweat Fittings
.07 Valve Nomenclature, Function and Service

PERFORMANCE ACTIVITIES: (cont.)

.08 Meter, Curb Cocks and Strainers
.09 Service Piping and Water Main Nomenclature
.10 Water and Hydrostatic Pressure
.11 Friction Loss Calculation
.12 Water Sources and Solvency

EVALUATION PROCEDURE:

When pretesting:

1. The student takes the unit multiple-choice pretest.
2. Successful completion is 4 out of 5 items for each LAP part of the pretest.
3. The student then takes a unit performance test if the unit pretest was successfully completed.
4. Satisfactory completion of the performance test is meeting the criteria listed on the performance test.

When post testing:

1. The student takes a multiple-choice unit post test and a unit performance test.
2. Successful unit completion is meeting the listed criteria for the performance test.

The performance test for this unit is combined with unit "Hot Water Supply".

FOLLOW-THROUGH:

Go to the first assigned Learning Activity Package listed on your Student Progress Record (SPR).

Student: ______________________ **File Code:** 73.02.02.00.A2-2

Date: ______________________ **Date Published:** 11-20-74

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UNIT PRETEST: COLD WATER SUPPLY

73.02.02.01

1. Hard copper tubing is available in:

   a. 30' lengths.
   b. 10' lengths.
   c. 20' lengths.
   d. 15' lengths.

2. Which of the following copper tubing types has the thickest wall, and is generally used for water service pipes underground?

   a. type "M".
   b. type "L".
   c. type "K".
   d. type "N".

3. Which type of copper tubing has a thin wall and is used for general plumbing and heating, but not underground?

   a. type "K".
   b. type "M".
   c. type "N".
   d. type "L".

4. What is the thickness of the wall of 2 1/2" type M copper tubing?

   See chart page 2.

   a. 0.095"
   b. 0.065"
   c. 0.080"
   d. 0.072"

5. If too much pressure is applied when using a tubing cutter, the result may be:

   a. a broken cutter.
   b. an "out of round" copper pipe.
   c. a chipped cutter wheel.
   d. "jammed roller wheels on the tubing cutter.

Diagram 14

SIZES AND WEIGHTS OF COPPER WATER TUBE

(In accordance with Simplified Practice Recommendation R217-46)

Standard Water Tube Size	Actual Outside Diameter	Nominal Wall Thickness			Theoretical Weight		
		Type K	Type L	Type M	Type K	Type L	Type M
Inches	Inches	Inches	Inches	Inches	Lb./Ft.	Lb./Ft.	Lb./Ft.
3/8	0.500	0.049	0.035	.....	0.269	0.198	.....
1/2	.625	.049	.040	.....	.344	.285	.....
5/8	.750	.049	.042	.....	.418	.362	.....
3/4	.875	.065	.045	.....	.641	.455	.....
1	1.125	.065	.050	.....	.839	.655	.....
1 1/4	1.375	.065	.055	.....	1.04	.884	.....
1 1/2	1.625	.072	.060	.....	1.36	.114	.....
2	2.125	.083	.070	.....	2.06	1.75	.....
2 1/2	2.625	.095	.080	0.065	2.93	2.48	2.03
3	3.125	.109	.090	.072	4.00	3.33	2.68
3 1/2	3.625	.120	.100	.083	5.12	4.29	3.58
4	4.125	.134	.110	.095	6.51	5.38	4.66
5	5.125	.160	.125	.109	9.67	7.61	6.66
6	6.125	.192	.140	.122	13.9	10.2	8.92
8	8.125	.271	.200	.170	25.9	19.3	16.5
10	10.125	.338	.250	.212	40.3	30.1	25.6
12	12.125	.405	.280	.254	57.8	40.4	36.7

73.02.02.02

6. Which of the following tools is used to enlarge the end of copper tubing?

   a. reamer.
   b. swage.
   c. pilot insert.
   d. honing bar.

7. What is the method used to join copper tubing without using a coupling?

   a. swaging.
   b. soldering.
   c. welding.
   d. epoxying.

8. Swaging is predominantly used on which of the following types of pipe?

   a. black cast iron.
   b. galvanized iron.
   c. copper.
   d. galvanized steel.

9. What is the purpose of swaging?

   a. to clean the inside surfaces of a piece of tubing.
   b. to diminish the outside diameter of an end of tubing.
   c. to enlarge the inside diameter of an end of tubing.
   d. to clean out corroded tubing.

10. Which of the following hammers are recommended for use when swaging copper tubing?

    a. ball peen.
    b. claw hammer.
    c. fiberglass - head hammer.
    d. 16 oz. stanley ripping hammer.

73.02.02.03

11. Why can good solder joints be made regardless of the position of copper tubing and fittings?

    a. the solder is applied prior to fitting the two pieces of tubing together.
    b. solder flow does depend upon gravity.
    c. solder flow does not depend upon gravity.
    d. because copper attracts solder.

73.02.02.03 (continued)

12. When heating a joint, only enough heat should be applied to:
    - a. char the flux.
    - b. burn the flux.
    - c. melt the solder.
    - d. lightly warm the tubing.

13. Soft solder may be used on pipes where the temperature will not exceed:
    - a. 300 degrees.
    - b. 250 degrees.
    - c. 150 degrees.
    - d. 200 degrees.

14. Why should the surfaces of all tubing be cleaned just before solding?
    - a. keeps oxidations of metal to a minimum.
    - b. helps the copper tubing to shine; thereby making the overall job more attractive.
    - c. assists the flow of water.
    - d. saves time; prevents the plumber from cleaning them later.

15. Before soldering the copper tubing, interior and exterior surfaces should be cleaned with which of the following?
    - a. sand paper.
    - b. file.
    - c. cleaning tool or steel wool.
    - d. crocus cloth.

73.02.02.04

16. Cast-type solder fittings are made in sizes from:
    - a. 1/4" - 8"
    - b. 1/2" - 6"
    - c. 1/8" - 4"
    - d. 1/8" - 12"

17. A 45 degree elbow is used to make a:
    - a. 1/4 bend.
    - b. 1/8 bend.
    - c. 1/6 bend.
    - d. 1/2 bend.

73.02.02.04 (continued)

18. Solder flows into a joint by which of the following?

    a. gravity flow.
    b. capillary action.
    c. osmosis.
    d. pressure.

19. A flared copper tube fitting is similar to which of the following galvanized iron fittings?

    a. 3/4" IPT 90° ell.
    b. bull head tee.
    c. ground joint union.
    d. 1/2" x 1/2" x 3/8" IPT tee.

20. Two 1/2" copper lines are to be extended from the end of a 3/4" galvanized iron pipe line. What fitting would be used?

    a. 1/2" copper to 1/2" IPT to 3/4" IPT tee.
    b. 1/2" IPT to 3/4" copper to 1/2" copper tee.
    c. 3/4" copper to 1/2" IPT to 3/4" copper tee.
    d. 3/4" IPT to 1/2" copper to 1/2" copper tee.

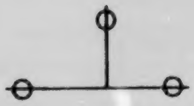
73.02.02.05

21. The size of copper pipe sweat type of branch fittings are expressed in terms of:

    a. the size of the outside diameter of the fitting.
    b. the size of inside diameter of the fitting.
    c. the pipe size.
    d. the fitting length.

22. What type of joint is used on the fitting below?

    a. soldered.
    b. welded.
    c. screwed.
    d. flanged.



23. The symbol in question 22 identifies which of the following?

    a. lateral tee.
    b. tee away from you.
    c. tee toward you.
    d. straight tee.

73.02.02.05 (continued)

24. When making a solder joint using a branch fitting, the source of heat (torch) should:

    a. be directed in the direction of solder flow.
    b. be held in one position.
    c. be directed to the inside of the fitting.
    d. be kept moving to distribute the heat.

25. If an assembly process of cleaning is used (clean a large number of joints before soldering), what is the maximum time lapse that should be allowed prior to soldering?

    a. no more than 24 hours.
    b. no more than 12 hours.
    c. no more than 16 hours.
    d. no more than 4 hours.

73.02.02.06

26. Which of the following copper sweat fittings is used to put in changes or make repairs to a system without taking the whole system apart?

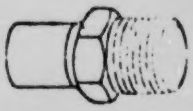
    a. bushing.
    b. union.
    c. male adapter.
    d. reducing coupler.

27. Dimensioning of sweat fittings is in terms of:

    a. the weight of the copper pipe used.
    b. the oustide diameter of the copper pipe.
    c. the inside diameter of the copper pipe.
    d. the alloy composition (95% copper, 5% aluminum) of the tubing.

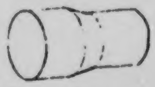
28. Identify the type of sweat fitting illustrated below:

    a. female adapter.
    b. male adapter.
    c. reducing coupling.
    d. drain coupling.



29. Identify the illustration below:

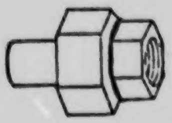
    a. crossover.
    b. flexible coupling.
    c. fitting reducer.
    d. union.



73.02.02.06 (continued)

30. What type of copper sweat fitting is depicted below?

    a. union.
    b. bushing.
    c. drain tee.
    d. male adapter.



73.02.02.07

31. On a ground key cock the handle is in what relation to the hole in the plug?

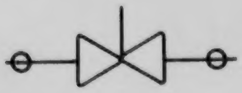
    a. at a 45 degree angle to it.
    b. diagonal to it.
    c. at a 90 degree angle across it.
    d. parallel with it.

32. When installing a compression valve that has a waste on it in a water supply system, how should the valve be positioned in relation to the waste location?

    a. position of the waste is not important.
    b. waste should be on the top side.
    c. waste should be on the bottom side.
    d. the waste should be placed on either side.

33. What is indicated by the symbol below?

    a. check valve.
    b. globe valve.
    c. gate valve.
    d. ground cock.



34. What type of joint is indicated by the symbol in question 33.

    a. screwed.
    b. welded.
    c. soldered.
    d. glued.

35. What type of valve is used to release the water in the tank of a water closet?

    a. globe valve.
    b. ball cock.
    c. compression valve.
    d. flush valve.

73.02.02.08

36. Where and how should the valve in a curb box be placed?

    a. on one edge, vertically.
    b. on one edge, horizontally.
    c. in the center, upright.
    d. on either edge.

37. Where should a plumber look for a water meter?

    a. near the main stack of a plumbing system.
    b. usually, where the water supply enters a dwelling.
    c. near the area floor drain.
    d. outside the house.

38. In what position should a water meter be installed?

    a. inclined.
    b. upright.
    c. horizontally.
    d. on its side.

39. When installing large water meters, how many (if any) valves should be installed?

    a. none.
    b. two.
    c. one.
    d. three.

40. What effect on water flow do meters have?

    a. they cause friction.
    b. they regulate water flow.
    c. they regulate water pressure.
    d. they determine water solvency.

73.02.02.09

41. What kind and type of pipe is used for a typical water service installation?

    a. type L soft.
    b. type K hard.
    c. type K soft.
    d. type L hard.

73.02.02.09

42. What precaution must be taken when installing a large, over 2", house drain?

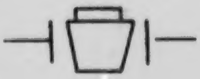
    a. use type L copper.
    b. use type M copper.
    c. do not use tarred oakum.
    d. do not use soft IPT.

43. If you located a curb box in front of a property, where would you find the corporation ferrule?

    a. in the water main in front of the curb cock.
    b. just prior to entering the house.
    c. in the house.
    d. near the water meter.

44. What is indicated by the symbol below?

    a. curb box.
    b. stop cock.
    c. water meter.
    d. water main.



45. How can galvanized pipes be stopped from sweating?

    a. cover with air cell covering and paint.
    b. wipe the pipes with cloth.
    c. replace with copper pipe.
    d. apply a cellulose covering.

73.02.02.10

46. The surface of still water is called:

    a. surface.
    b. head.
    c. top.
    d. eddy.

47. If a 1" x 1" x 12" column of water weighs .434 pounds, what is the weight of one cubic inch?

    a. 5.208 lbs.
    b. .036 lbs.
    c. .069 lbs.
    d. 1.525 lbs.

73.02.02.10 (continued)

48. What type of pressure gauge would you use on a vapor heating system?

    a. micrometer.
    b. altitude gauge.
    c. pressure gauge.
    d. vacuum gauge.

49. How much will thirty pounds of pressure raise water in a pipe (approximately)?

    a. .434 feet.
    b. 69.3 feet.
    c. 30 feet.
    d. 30 inches.

50. Which of the following is the least compressable?

    a. freon 22.
    b. freon 11.
    c. air.
    d. water.

73.02.02.11

51. Give the friction loss at the rear of a basement under the following conditions; the flow is 10 G.P.M., the 1/2" pipe rises 5'-6" to the ceiling, extends across the ceiling 7'-6" to center and 27' to the rear wall.

    a. 25.8 lbs.
    b. 39.2 lbs.
    c. 36.7 lbs.
    d. 19.5 lbs.

52. Give the friction loss in 185' of 1/2" pipe with a flow of 8 G.P.M. Suppose in this case that only 25 pounds pressure is available. What should be done to assure the flow required?

    a. replace with 1" pipe.
    b. replace with 3/6" pipe.
    c. replace with 1/2" gal. pipe.
    d. replace with 3/4" gal. pipe.

53. A 2" water main extends 1,000' to supply a tank 10' x 15' x 6'. At the rate of 12 G.P.M. what is the friction loss?

    a. 3.9 lbs.
    b. 3 lbs.
    c. .03 lbs.
    d. 39 lbs.

73.02.02.11 (continued)

54. A 2" water main extends 1,000' to supply a tank 10' x 15' x 6' at the rate of 12 G.P.M. How long will it take to fill the tank?

a. 5.6 hours.
b. 56 minutes.
c. 562.5 minutes.
d. 5625 seconds.

55. On a line of pipe 125' long, six faucets, each discharging 5 G.P.M., are installed. What is the minimum pressure at the main and what size pipe is required? The pressure at the faucet is 15 pounds per inch.

a. 2" pipe, 137.5 lbs.
b. 1 1/4" pipe, 27.74 lbs.
c. 1/2" pipe, 39.2 lbs.
d. 3/4" pipe, 48.5 lbs.

73.02.02.12

56. A deep well is one which is:

a. over 100' deep.
b. under 25' deep.
c. over 50' deep.
d. over 30' deep.

57. What is the meaning of evaporation?

a. the slow passage of water to air.
b. the rapid passage of air to water.
c. the slow passage of air to water.
d. the rapid passage of water to the ground.

58. What kind of pipe is the most dangerous to use as a water supply?

a. brass.
b. copper.
c. iron.
d. lead.

59. **Which of the following water sources proves that water flows below grade level or underground?**

a. river.
b. geyser.
c. lake.
d. stream.

73.02.02.12

60. What happens to most of the rainfall?

    a. it evaporates into the air.
    b. it runs to the river.
    c. it settles into the ground.
    d. it disappears to unknown sources.

UNIT TEST ANSWER SHEET

PRETEST

Occupational Area: ______

File Code: 73.02.02.00.A2-2

Name: ______

ANSWERS

73.02.02.01	1. C ______	73.02.02.05	21. C ______	73.02.02.09	41. C ______
	2. C ______		22. A ______		42. C ______
	3. D ______		23. D ______		43. A ______
	4. B ______		24. D ______		44. B ______
	5. B ______		25. D ______		45. A ______
3.02.02.02	6. B ______	73.02.02.06	26. B ______	73.02.02.10	46. B ______
	7. A ______		27. C ______		47. B ______
	8. C ______		28. B ______		48. D ______
	9. C ______		29. C ______		49. B ______
	10. A ______		30. A ______		50. D ______
73.02.02.03	11. C ______	73.02.02.07	31. D ______	73.02.02.11	51. A ______
	12. C ______		32. C ______		52. A ______
	13. B ______		33. B ______		53. B ______
	14. A ______		34. C ______		54. C ______
	15. C ______		35. D ______		55. B ______
73.02.02.04	16. D ______	73.02.02.08	36. C ______	73.02.02.12	56. D ______
	17. B ______		37. B ______		57. A ______
	18. B ______		38. B ______		58. D ______
	19. C ______		39. B ______		59. B ______
	20. D ______		40. A ______		60. B ______

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File Code: 73.02.02.01.A2-0

Date Published: 7/8/75

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Copper Pipe Nomenclature and Cutting

OBJECTIVES:

Discriminate between soft and hard types of copper pipe by weight and size.

Express the reason for using copper pipe and recognize when and where it should be used.

Identify the procedures for cutting copper pipe.

EVALUATION PROCEDURE:

This LAP is considered successfully completed when the student correctly answers 8 out of 10 items on a multiple-choice test.

RESOURCES:

Related Information Plumbing 2, Slater.

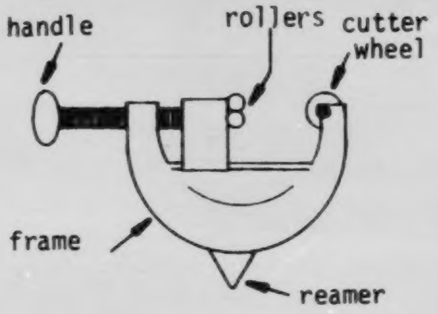
PROCEDURE:

1. Using Related Information Plumbing 2, do the following assignments:
   a. Read about copper pipe on pages 5-6.
   b. Answer questions 1-7 and 9-10 on pages 9-10.
   c. Check answers with the answer key.
2. Read the following:

DIRECTIONS FOR CUTTING COPPER TUBING USING A TUBING CUTTER

(1) Adjust the space between the cutter wheel and the rollers to allow the tubing to fit between them. (The handle is turned counterclockwise to increase the opening.)

(2) Position the cutter wheel at the point where the cut is desired.



Principal Author(s):

Arneson, Bundy, Frisbee

PROCEDURE: (cont.)

(3) Turn the cutter handle clockwise until the cutting wheel begins to bite into the tubing.

KEY POINT: Be careful not to cause the pipe to get out of round by putting too much pressure on the tubing.

(4) Rotate the complete tubing cutter around the tubing. Go around the tubing twice before taking the next step.

(5) Set the cutting wheel a little deeper by making adjustment, Step (3).

(6) Repeat Step (4) followed by Step (5).

(7) Continue sequence of steps (3), (4) and (5) until the tubing is cut through.

(8) Using the reamer on the tube cutter, ream the inside of the cut-off pipe.

3. Take the LAP test.
4. Score the LAP test and return it.
5. If the LAP test is satisfactory, begin the next assigned LAP.

   If not satisfactory, proceed as directed by the instructor.

Student: ______________________ File Code: 73.02.02.01.A2-2

Date: ______________________ Date Published: 11/21/74

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LAP TEST: COPPER PIPE NOMENCLATURE AND CUTTING

1. Which of the following is a disadvantage of copper tubing?
   a. its degree of expansion.
   b. it is impervious to rust.
   c. bends easily around obstructions.
   d. can withstand freezing several times before breaking.

2. Copper tubing is available in which of the following weights?
   a. heavy and extra heavy.
   b. standard, heavy, and extra heavy.
   c. medium, and extra heavy.
   d. light, medium, and heavy.

3. Hard copper tubing is available in:
   a. 30' lengths.
   b. 10' lengths.
   c. 20' lengths.
   d. 15' lengths.

4. Which of the following copper tubing types has the thickest wall, and is generally used for water service pipes underground?
   a. type "M".
   b. type "L".
   c. type "K".
   d. type "N"

5. When using a tubing cutter, at what point should the cutter wheel be placed?
   a. 1/2" from the point where the cut is desired.
   b. 1/4" from the point where the cut is desired.
   c. at the point where the cut is desired.
   d. 1/8" from the point where the cut is desired.

6. How many revolutions should be made around the copper tubing with the tubing cutter before setting the cutter wheel a little deeper?
   a. 2
   b. 3
   c. 4
   d. 1

7. What is the difference in weight of 10' of 3" K and L type copper tubing? (Use the chart on page 3.)

    a. 67.0 lbs.
    b. 6.7 lbs.
    c. 0.067 lbs.
    d. 0.67 lbs.

8. What is the thickness of the wall of 2 1/2" type M copper tubing? (Use the chart on page 3)

    a. 0.095"
    b. 0.065"
    c. 0.080"
    d. 0.072"

9. What is the weight in pounds of a 60' coil of 3/4" type K copper tubing? (Use the chart on page 3.)

    a. 384.60 lbs.
    b. 0.641 lbs.
    c. 6.41 lbs.
    d. 38.460 lbs.

10. If too much pressure is applied when using a tubing cutter, the result may be:

    a. a broken cutter.
    b. an "out of round" copper pipe.
    c. a chipped cutter wheel.
    d. "jammed" roller wheels on the tubing cutter.

Diagram 14

SIZES AND WEIGHTS OF COPPER WATER TUBE

(In accordance with Simplified Practice Recommendation R217-46)

Standard Water Tube Size	Actual Outside Diameter	Nominal Wall Thickness			Theoretical Weight		
		Type K	Type L	Type M	Type K	Type L	Type M
Inches	Inches	Inches	Inches	Inches	Lb./Ft.	Lb./Ft.	Lb./Ft.
⅜	0.500	0.049	0.035	.....	0.269	0.198	.....
½	.625	.049	.040	.....	.344	.285	....
⅝	.750	.049	.042	.....	.418	.362	.....
¾	.875	.065	.045	.....	.641	.455	.....
1	1.125	.065	.050	.....	.839	.655	.....
1¼	1.375	.065	.055	.....	1.04	.884	.. ..
1½	1.625	.072	.060	.....	1.36	.114	..
2	2.125	.083	.070	.....	2.06	1.75	..
2½	2.625	.095	.080	0.065	2.93	2.48	2.03
3	3.125	.109	.090	.072	4.00	3.33	2.68
3½	3.625	.120	.100	.083	5.12	4.29	3.58
4	4.125	.134	.110	.095	6.51	5.38	4.66
5	5.125	.160	.125	.109	9.67	7.61	6.66
6	6.125	.192	.140	.122	13.9	10.2	8.92
8	8.125	.271	.200	.170	25.9	19.3	16.5
10	10.125	.338	.250	.212	40.3	30.1	25.6
12	12.125	.405	.280	.254	57.8	40.4	36.7

LAP TEST ANSWER KEY: COPPER PIPE NOMENCLATURE AND CUTTING

1. A
2. D
3. C
4. C
5. C
6. A
7. D
8. B
9. D
10. B

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Learning Activity Package

Student: ________________

Date: ________________

PERFORMANCE ACTIVITY: Swaging Copper Tubing

OBJECTIVES:

Prepare the end of a soft copper tubing for direct coupling to another piece of copper tubing by using a swaging tool.

Swage the copper tubing using the given procedure and meeting the specifications for the coupling.

EVALUATION PROCEDURE:

Successful completion of this LAP will be determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Sweating Copper Tubing" LAP test and is to be taken after completing that LAP.

Swaged ends of copper tubing meet given specifications.

RESOURCES:

Hammer.
Swaging set.
Tubing cutter.

PROCEDURE:

1. Read the following.

   Copper tubing may be joined without the use of a coupling. The method used to do this is to enlarge the inside diameter of one end to be joined. It is enlarged enough to allow the end of the other piece to be inserted. The joint is then soldered or sweated together. The enlarging of the copper tubing is done with a tool called a swage or swaging tool. The process of enlarging the tubing is called swaging.

2. Have the instructor fill in the following information.

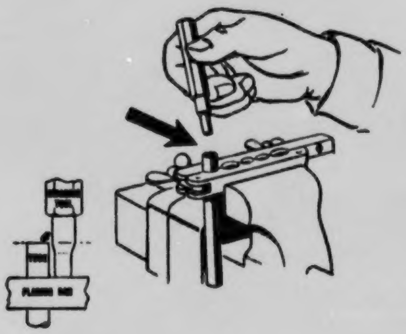
TUBING	1	2
Type	______	______
Size	______	______

Principal Author(s): Arneson, Bundy, Frisbee

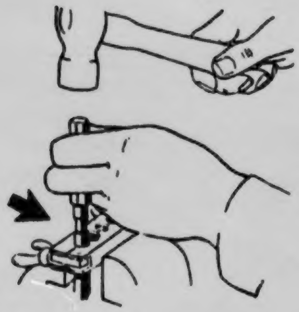
3. Cut and ream two pieces of the copper tubing of each size shown above. Cut each piece four inches in length. Ream the burrs from the inside of the tubing using the triangular reamer attached to the tubing cutter.

4. Obtain the proper size swage and a flaring or swaging bar.

5. Set the piece of tubing to be swaged into the flaring or swaging bar as shown in Figure 1. The top of the level on the swage provides the gage point for distance that the copper tube is inserted through the swaging bar. Then clamp the bar into a vice as shown in Figure 1.



6. Insert the swaging tool into the tubing as illustrated in Figure 2.



7. Using light strokes with a ball peen hammer, drive the swaging tool into the tubing. KEY POINT: The swaging tool should be turned slightly after each stroke.

8. Remove the swaging tool when the tubing has been swaged.

9. Remove the tubing from the swaging bar.

10. Begin with step 4 and swage the other pair of copper tubing pieces.

11. Have the instructor evaluate the swaged tubing.

12. If satisfactory, put away the tools clean up the workstation. If not satisfactory, proceed as the instructor directs.

    KEY POINT: Save the swaged tubing for the next LAP.

13. Go to the next assigned LAP.

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Learning Activity Package

Student:

Date:

PERFORMANCE ACTIVITY: Sweating Copper Tubing

OBJECTIVES:

Solder copper tubing joints that have been swaged or have prepared fittings.

Perform the joint sweating according to specifications using appropriate tools, equipment and procedures.

EVALUATION PROCEDURE:

The successful completion of this LAP will be determined by correctly answering 8 out of 10 items on a multiple-choice test.

Sweated copper tubing joints meet given specifications.

RESOURCES:

Related Information Plumbing 2, Slater.

Fitting brush.
Sandcloth.
Solder.
Solder paste.
Torch.

PROCEDURE:

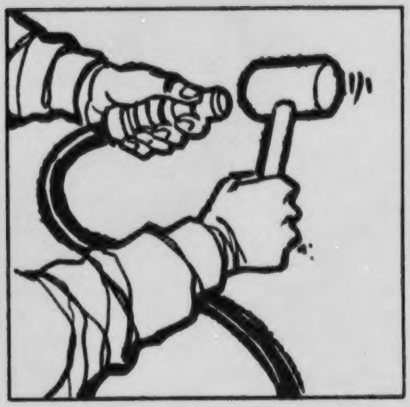
1. Read the following.

   The soldering or sweating of metals is used to join copper tubing and fittings or swaged copper tubing. It is important to understand some things about the sweating process as it applies to joining copper tubing and fittings.

   The position of tubing and fittings is not important. **Solder joints** may be made regardless of the position of the tubing and fittings. This is true because the solder flow does not depend upon gravity. The solder flows by capillary action. This capillary action will draw the molten solder into the small clearance space between the surfaces to be joined. Because this capillary action depends upon a snug fit with uniform clearance, it may be well to size the copper tube if it has been knocked out of round. Sizing tools are used to correct the outside diameter should it become necessary.

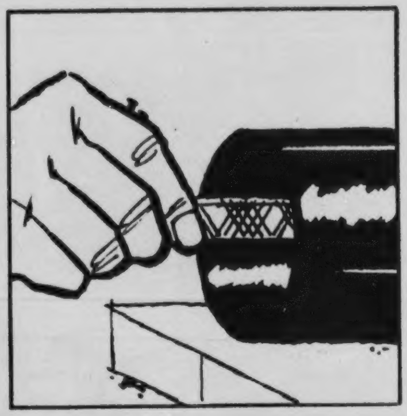
Principal Author(s): Arneson, Bundy, Frisbee

Figure 1 shows the sizing.

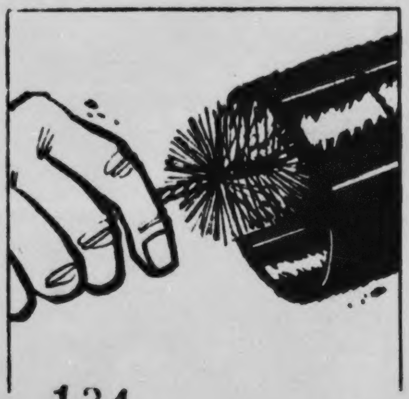


The uniform flow of solder in the joint makes a bond of great strengths. To assist with a complete bond, a flux is used to clean the surfaces that are to be bonded together with solder. Application of flux to all parts of the surface to be bonded is important. It is also necessary to heat the joint enough to melt the solder but not too much to cause the flux to burn or char. Any non-liquid residue may prevent or hinder the flow of solder in the joint. Avoid quenching a joint. Allow it to air cool.

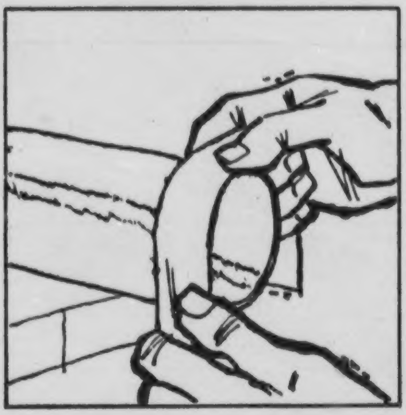
2. Using Related Information Plumbing 2, do the following assignments:
   a. Read about copper tube joints on pages 7-9.
   b. Answer questions 21 through 25 on page 11.
   c. Check the answers with the answer key.
3. Take two satisfactorily swaged pieces of copper tubing from the previous LAP and remove burrs from both inside and outside edges. Use a deburring tool or file as shown in Figure 2.



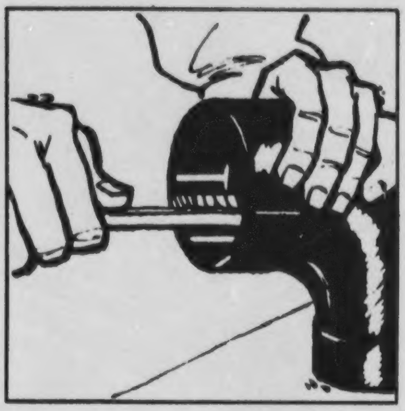
4. Clean the inside of a fitting with a wire brush as shown in Figure 3.



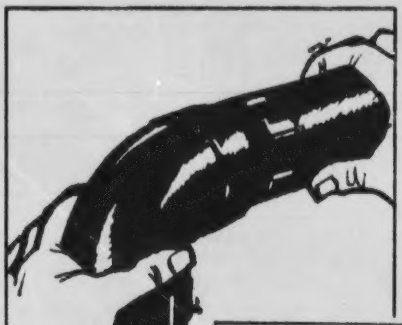
5. Clean the outer surface of the tubing with sandcloth, Scotchbrite or similar pad as shown in Figure 4. KEY POINT: Cleaning of all surfaces should be done just before the soldering. This helps oxidation of metal to a minimum.



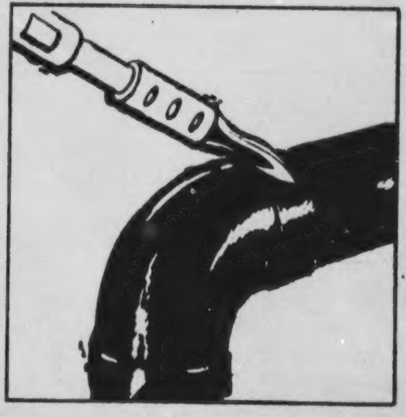
6. Apply a thin coat of flux to both interior of the fitting or swaged tube and the exterior of the tubing. Spread the flux evenly with a flux brush as shown in Figure 5.



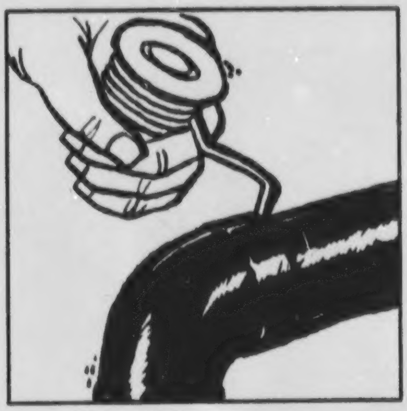
7. Assemble the fitting and tubing as shown in Figure 6. Turn the tubing back and forth several times after it is inserted into the fitting. This will help distribute the flux evenly on the surfaces making contact.



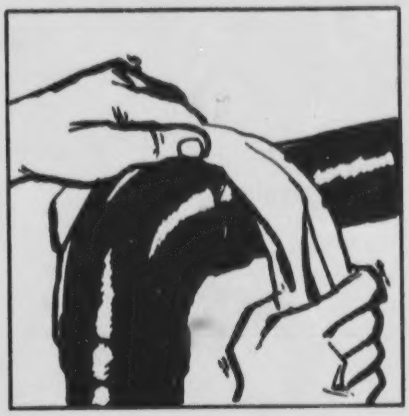
8. Apply flame to the shoulder of the fitting with the direction of the flame toward the tubing. Heat toward the opening of the fitting as shown in Figure 7. KEY POINT: Occassionally remove the flame and touch the joint with solder. This is to determine if the metal is hot enough to melt the solder.



9. Apply the solder by touching it near the joint as shown in Figure 8. When the joint is hot enough, capillary action draws it into the space between the surfaces to be joined. KEY POINT: When a ring of solder appears all around the circumference of the joint, a strong leakproof joint has been formed.



10. Wipe the joint clean while the solder is still molten as shown in Figure 9.



11. Return to step 3 and proceed with the second swagged tubing.

12. When finished sweating the joints, have them evaluated by the instructor.

13. If they are satisfactory, clean and return the tools, clean the workstation, and take the LAP test. If joints are unsatisfactory, proceed as directed by the instructor.

14. Score the LAP test and return it to an instructor.

15. If the LAP test is satisfactory, begin the next assigned LAP. If the LAP test is unsatisfactory, proceed as the instructor advises.

Student: ______________________ File Code: 73.02.02.02.A2-2 73.02.02.03.A2-2

Date: ______________________ Date Published: 11/21/74

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LAP TEST: SWAGING AND SWEATING COPPER TUBING

73.02.02.02

1. Why can good solder joints be made regardless of the position of copper tubing and fittings?

   a. the solder is applied prior to fitting the two pieces of tubing together.
   b. solder flow does depend upon gravity.
   c. solder flow does not depend upon gravity.
   d. because copper attracts solder.

2. Before two pieces of tubing are fitted together, what should be done to assure a complete bond?

   a. both ends should be swaged.
   b. both ends should be reamed.
   c. application of flux.
   d. only one end should be reamed.

3. Soft solder may be used on pipes where the temperature will not exceed:

   a. 300 degrees.
   b. 250 degrees.
   c. 150 degrees.
   d. 200 degrees.

4. To distribute the solder flux after applying it to an end on a piece of copper tubing:

   a. heat the fitting and tubing.
   b. rotate the tubing in the fitting.
   c. use a cloth, not your finger.
   d. use a tubing cleaner.

5. The length of solder should equal:

   a. the diameter of the tubing.
   b. the radius of the tubing.
   c. the circumference of the tubing.
   d. the length of the tubing.

73.02.02.03

6. Which of the following tools is used to enlarge the end of copper tubing?

   a. reamer.
   b. swage.
   c. pilot insert.
   d. honing bar.

7. Swaging is predominantly used on which of the following types of pipe?

   a. black cast iron.
   b. galvanized iron.
   c. copper.
   d. galvanized steel.

8. What is the purpose of swaging?

   a. to clean the inside surfaces of a piece of tubing.
   b. to diminish the outside diameter of an end of tubing.
   c. to enlarge the inside diameter of an end of tubing.
   d. to clean out corroded tubing.

9. Swaging is a preparation for which of the following?

   a. cementing.
   b. welding.
   c. soldering.
   d. taping.

10. When swaging copper tubing, which of the following tools should be used to hold the tubing?

    a. channel lock pliers.
    b. vice.
    c. vice grip pliers.
    d. flaring block.

LAP TEST ANSWER KEY: SWAGING AND SWEATING COPPER TUBING

73.02.02.02

1. B
2. C
3. C
4. C
5. D

73.02.02.03

6. C
7. C
8. B
9. B
10. A

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File Code: 73.02.02.04.A2-0

Date Published: 7/9/75

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Copper Sweat Angle Fittings

OBJECTIVES:

Identify copper sweat angle fittings by size and name.

Express the purpose of various copper sweat angle fittings and recognize when and where they are used.

EVALUATION PROCEDURE:

Correctly answer 8 out of 10 items on a multiple-choice test that is combined with "Copper Sweat Branch Fittings" LAP test and is taken after completing that LAP.

RESOURCES:

Related Information Plumbing 2, Slater.

PROCEDURE:

1. Read about copper sweat angle fittings on page 7 in the section entitled "Copper Tube Fittings: Solder-Type" in Related Information Plumbing 2.

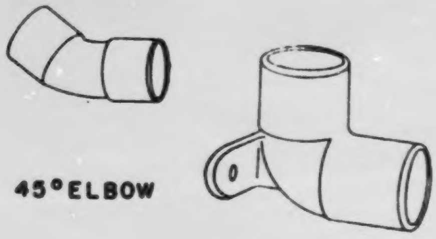
2. Read the following.

Additional types of angle fittings are shown in Figure 1.

The 45° elbow is used to make one-eighth bends.

The dropear elbow is made to conveniently fasten pipe assembly at the bend. This provides for support and reduces vibration of the pipe assembly.

FIGURE 1



45° ELBOW

90° DROP EAR ELBOW

Principal Author(s):

Arneson, Bundy, Frisbee

PROCEDURE: (cont.)

3. Using Related Information Plumbing 2, answer questions 8, 11 and 13 on pages 9-10 and prepare the sketch requested on page 10. Check the answers with the answer key.
4. Obtain the box of assorted copper sweat type of angle fittings.
5. Use the attached form "Fittings Indentification" to record the description and function for each of the numbered fittings in the box.
6. Check answers with the answer key.
7. Begin the next assigned LAP.

FITTINGS IDENTIFICATION

Directions: Select a fitting from the assortment. After the number below that matches the fitting number write the description and function.

Work Station Number________________________ Box Number________________________________

FITTING NUMBER	DESCRIPTION (Size, Weight, Type, Etc.)	FUNCTION (For What Used)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

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Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Copper Sweat Branch Fittings

OBJECTIVES:

Identify copper sweat branch fittings by size, symbol and name.

Express the purpose for the various copper sweat branch fittings and recognize when and where they are used.

Complete copper sweat branch fittings assemblies that meet specifications for installation using appropriate procedures and tools.

EVALUATION PROCEDURE:

The succesful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

Copper sweat branch fittings assembly meets given specifications.

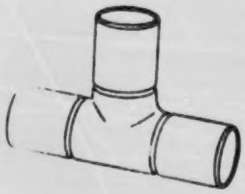
RESOURCES:

Fittings.
Fitting brush.
Pipe.
Torch.
Tubing cutter.

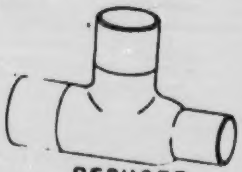
PROCEDURE:

1. Read the following.

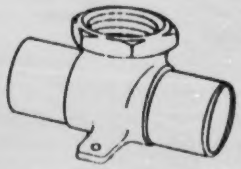
   Copper pipe sweat type of branch fittings are used to provide branches to a run in supply systems. Various branch fittings are available. These branch fittings are shown below.



TEE



REDUCER TEE



DROP EAR TEE

Principal Author(s):

Arneson, Bundy, Frisbee

PROCEDURE: (cont.)

Branch fittings are basically tees. The size of copper pipe sweat type of branch fittings are expressed in terms of the pipe size. The method of dimensioning the branch fittings is the same as the other type of copper sweat fittings.

2. Obtain the box of assorted copper sweat branch fittings.

3. Record the description and function on the attached form "Fittings Identification" for each of the numbered branch sweat fittings in the box.

4. Check answers with the answer key.

5. If they are satisfactory, have the instructor dimension the attached sketch "Sweat Branch Fittings Assembly."

   If the identification was unsatisfactory, proceed as directed by the instructor.

6. Assemble the pipe and fittings as shown on the sketch.

7. Have the instructor evaluate the copper pipe and fitting assembly.

8. If satisfactory, clean and return tools, clean work area and take the LAP test:

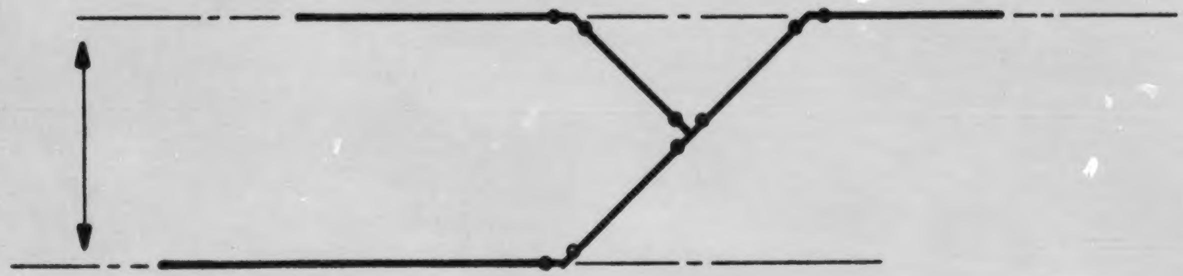
   If unsatisfactory, proceed as the instuctor directs.

9. Score the LAP test and return it.

10. If the LAP test is satisfactory, begin the next assigned LAP.

    If the LAP test is unsatisfactory, proceed as directed by the instructor.

Sweat Branch Fitting Assembly



FITTINGS IDENTIFICATION

Directions: Select a fitting from the assortment. After the number below that matches the fitting number write the description and function.

Work Station Number______________________ Box Number____________________________

FITTING NUMBER	DESCRIPTION (Size, Weight, Type, Etc.)	FUNCTION (For What Used)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Student: ______________________ File Code: 73.02.02.04.A2-2
73.02.02.05.A2-2

Date: ______________________ Date Published: 11/21/74

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LAP TEST: COPPER SWEAT BRANCH AND ANGLE FITTINGS

73.02.02.04

1. What do the letters I.P.T. stand for?

   a. inside pipe thickness.
   b. iron pipe thread.
   c. internal potential thermostat.
   d. inferior pipe tubing.

2. Wrought-type solder fittings are made in size from:

   a. 1/2" - 6"
   b. 1/8" - 4"
   c. 1/8" - 12"
   d. 1/4" - 8"

3. Cast-type solder fittings are made in sizes from:

   a. 1/4" - 8"
   b. 1/2" - 6"
   c. 1/8" - 4"
   d. 1/8" - 12"

4. Solder flows into a joint by:

   a. gravitation pull.
   b. capillary action.
   c. atmospheric action.
   d. suction created by a partial vacuum.

5. A 45 degree elbow is used to make a:

   a. 1/4 bend.
   b. 1/8 bend.
   c. 1/6 bend.
   d. 1/2 bend.

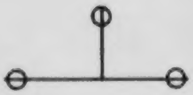
73.02.02.05

6. The size of copper pipe sweat type of branch fittings are expressed in terms of:

   a. the size of the outside diameter of the fitting.
   b. the size of inside diameter of the fitting.
   c. the pipe size.
   d. the fitting length.

7. This symbol identifies which of the following?

   a. lateral tee.
   b. tee away from you.
   c. tee toward you.
   d. straight tee.

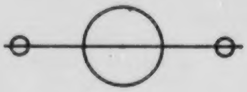


8. If an assembly process of cleaning is used (clean a large number of joints before soldering), what is the maximum time lapse that should be allowed prior to soldering?

   a. no more than 24 hours.
   b. no more than 12 hours.
   c. no more than 16 hours.
   d. no more than 4 hours.

9. What fitting is indicated by this symbol?

   a. tee.
   b. elbow.
   c. Y branch.
   d. coupling.



10. What direction in relation to you does the symbol in question 9 indicate?

   a. it is not indicated.
   b. toward you.
   c. parallel with you.
   d. away from you.

LAP TEST ANSWER KEY: COPPER SWEAT BRANCH AND ANGLE FITTINGS

73.02.02.04

1. B
2. B
3. D
4. B
5. B

73.02.02.05

6. C
7. D
8. D
9. A
10. D

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Date Published: 7/9/75

Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Miscellaneous Copper Sweat Fittings

OBJECTIVES:

Identify the types and sizes of various copper sweat fittings that are classified outside the categories of copper sweat angle and branch fittings (like bushings, couplings and plugs).

Express the purpose for these miscellaneous copper sweat fittings.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

RESOURCES:

Assortment of miscellaneous copper sweat fittings.

PROCEDURE:

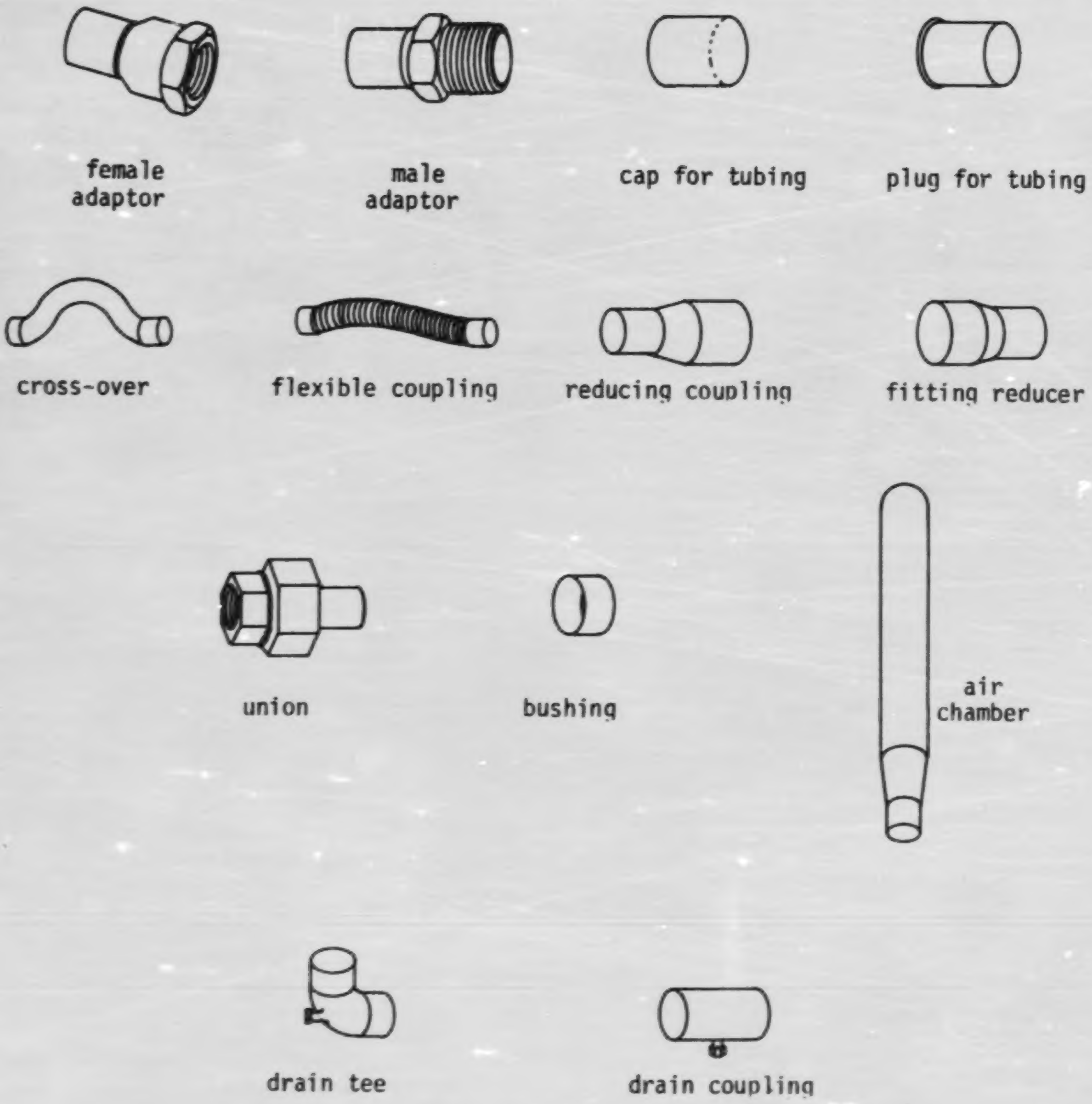
1. Read the following.

   Some of the copper pipe sweat fittings used are not angle or branch fittings. The more commonly used sweat fittings not identified thus far are shown and named in Figure 1. (Use the diagrams on page 2.)

   Sweat adapters are used to change from copper tubing to threaded pipe. Shown in Figure 1 are two types of adapters available for connecting copper tubing directly to the threaded pipe (female adapter) or to a threaded pipe fitting (male adapter). Adapters are also available in reducing styles.

   In dimensioning an adapter, the copper opening is given first and the iron next, followed by the type of adaption that takes place. An example would be 3/4" to 1/2" copper male adapter. In this example, the copper is 3/4" and the iron is 1/2". A 3/4" to 1/2" copper sweat to iron would adapt a copper tube size of 3/4" to a threaded pipe size of 1/2".

Principal Author(s): Arneson, Bundy, Frisbee



female adaptor

male adaptor

cap for tubing

plug for tubing

cross-over

flexible coupling

reducing coupling

fitting reducer

union

bushing

air chamber

drain tee

drain coupling

FIGURE 1

A cap fitting closes off the end of a copper tube. A plug fitting is used to close the opening in a sweat fitting. Both the plug and cap are identified by the copper pipe size with which it is used.

The crossover is used when a copper pipe run crosses another pipe run.

Couplings are used to connect the ends of two pieces of tubing. A reducing coupling would connect the ends of two different sizes of tubing. A flexible coupling is generally used under two conditions. One is when it is difficult to establish the angle required. The other is when joining appliances or equipment that does not allow access to the connection when the appliance is in place (recessed equipment).

A sweat bushing may be used to connect the ends of two copper pipes with different sizes.

Fitting reducers are used to connect a copper pipe to a fitting that was made to take a different size copper pipe. Unions are used to allow easy disassembly of pipe system parts. Unions are also used to put in changes or make repairs to a system without taking the whole system apart. Air chambers are installed to eliminate water hammer.

Drain tees and drain couplings are used in the pipe system low places.

Dimensioning of the sweat fittings is in terms of the inside diameter for the copper pipe used with that fitting.

2. Obtain the box of assorted miscellaneous copper sweat fittings.

3. Complete the attached sheet "Fittings Identification" according to the directions on the sheet.

4. Check answers with the answer key.

5. If the descriptions and functions are satisfactory, take the LAP test.

   If the descriptions and functions are not satisfactory, proceed as the instructor directs.

6. Score the LAP test and return it.

7. If the LAP test is satisfactory, begin the next assigned LAP.

   If the LAP test is unsatisfactory, proceed as directed by the instructor.

73.02.02.06.A2-0

FITTINGS IDENTIFICATION

Directions: Select a fitting from the assortment. After the number below that matches the fitting number write the description and function.

Work Station Number__________________ Box Number________________________

FITTING NUMBER	DESCRIPTION (Size, Weight, Type, Etc.)	FUNCTION (For What Used)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Student: ______________________ File Code: 73.02.02.06.A2-2

Date: ______________________ Date Published: 11/21/74

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LAP TEST: MISCELLANEOUS COPPER SWEAT FITTINGS

1. Which of the following is used to close the opening in a sweat fitting?

   a. cap fitting.
   b. plug fitting.
   c. crossover.
   d. drain tee.

2. What type of copper sweat fitting is used when it is difficult to estimate the angle required?

   a. fitting reducer.
   b. flexible coupling.
   c. union.
   d. drain coupling.

3. What is the function of sweat adapters?

   a. used to change the size of copper tubing (increase).
   b. used to change threaded pipe to copper tubing.
   c. used to change copper tubing to threaded pipe.
   d. used to change the size of copper tubing (decrease).

4. What sweat fitting is used to connect the ends of two pieces of tubing?

   a. drain tee.
   b. coupling.
   c. fitting reducer.
   d. female adapter.

5. The sweat fitting which is used to allow easy disassembly of pipe system parts is a:

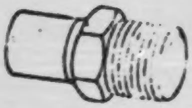
   a. sweat bushing.
   b. union.
   c. fitting reducer.
   d. air chamber.

6. Which of the following copper sweat fittings is used to put in changes or make repairs to a system without taking the whole system apart?

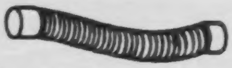
   a. bushing.
   b. union.
   c. male adapter.
   d. reducing coupler.

7. Dimensioning of sweat fittings is in terms of:
   - a. the weight of the copper pipe used.
   - b. the outside diameter of the copper pipe.
   - c. the inside diameter of the copper pipe.
   - d. the alloy composition (95% copper, 5% aluminum) of the tubing.

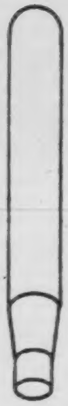
8. Identify the type of sweat fitting illustrated below:
   - a. female adapter.
   - b. male adapter.
   - c. reducing coupling.
   - d. drain coupling.



9. Which type of sweat fitting is depicted below?
   - a. flexible coupling.
   - b. reducing coupling.
   - c. drain coupling.
   - d. fitting reducer.



10. What type of copper sweat fitting is depicted below?
    - a. air chamber.
    - b. bushing.
    - c. drain tee.
    - d. male adapter.



LAP TEST ANSWER KEY: MISCELLANEOUS COPPER SWEAT FITTINGS

1. B
2. B
3. C
4. B
5. B
6. B
7. C
8. B
9. A
10. A

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File Code: 73.02.02.07.A2-0

Date Published: 7/9/75

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Valve Nomenclature, Function and Service

OBJECTIVES:

Identify fluid control valves by purpose, symbol and size and recognize when and where they are used.

Service various types of valves to meet manufacturer's operating standards.

Install valves according to specifications.

Valve service and installation is to be performed using appropriate tools and following given procedures.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

Service and installation of valves meet manufacturer's operation standards.

RESOURCES:

Plumbers and Pipe Fitters Library: Drainage, Fittings, Fixtures, Volume 2, Oravetz.

Related Information Plumbing 1, Slater.

Related Information Plumbing 2, Slater.

Pipe and fittings.
Pipe wrench.
Tape measure.
Torch.
Tubing cutter.
Valves.

PROCEDURE:

1. Using Related Information Plumbing 1, do the following assignments:
   a. Read about ground key cocks on pages 96-97.

Principal Author(s):

Arneson, Bundy, Frisbee

PROCEDURE: (cont.)

  b. Answer the questions on page 98. Check answers with answer key.
  c. Read about the compression valves on pages 99-100.
  d. Answer the questions and make the sketch requested on pages 100-101. Check answers with the answer key.
  e. Read about the tank ball cock and tank flush valve on pages 106-108.
  f. Answer the questions on pages 108-110. Check answers with answer key.

2. Using Related Information Plumbing 2, do the following assignments:
   a. Read about globe, gate and check valves on pages 55-59.
   b. Answer the questions on pages 59-61. Check answers with answer key.
   c. Read about back siphonage and cross connections on pages 120-122.
   d. Answer the questions on pages 122-123. Check answers with answer key.
3. For additional information about valves, read pages 203-229 in Plumbers and Pipe Fitters Library: Drainage, Fittings, Fixtures, Volume 2.
4. Obtain the box of assorted valves and complete the attached "Valve Identification" sheet. Follow the directions given on the sheet.
5. Check answers with the answer key.
6. If the statements are satisfactory, assemble the valves and pipe as shown on the attached sketch "Valve Assembly."

   If the statements are not satisfactory, proceed as the instructor directs.
7. When the valve assembly is completed, have the instructor evaluate it.
8. If the valve assembly is satisfactory, clean and return tools and materials to storage and take the LAP test.

   If the valve assembly is unsatisfactory, proceed as directed by the instructor.
9. Score the LAP test and return it.
10. If the LAP test is satisfactory, begin the next assigned LAP.

    If the LAP test is unsatisfactory, proceed as the instructor suggests.

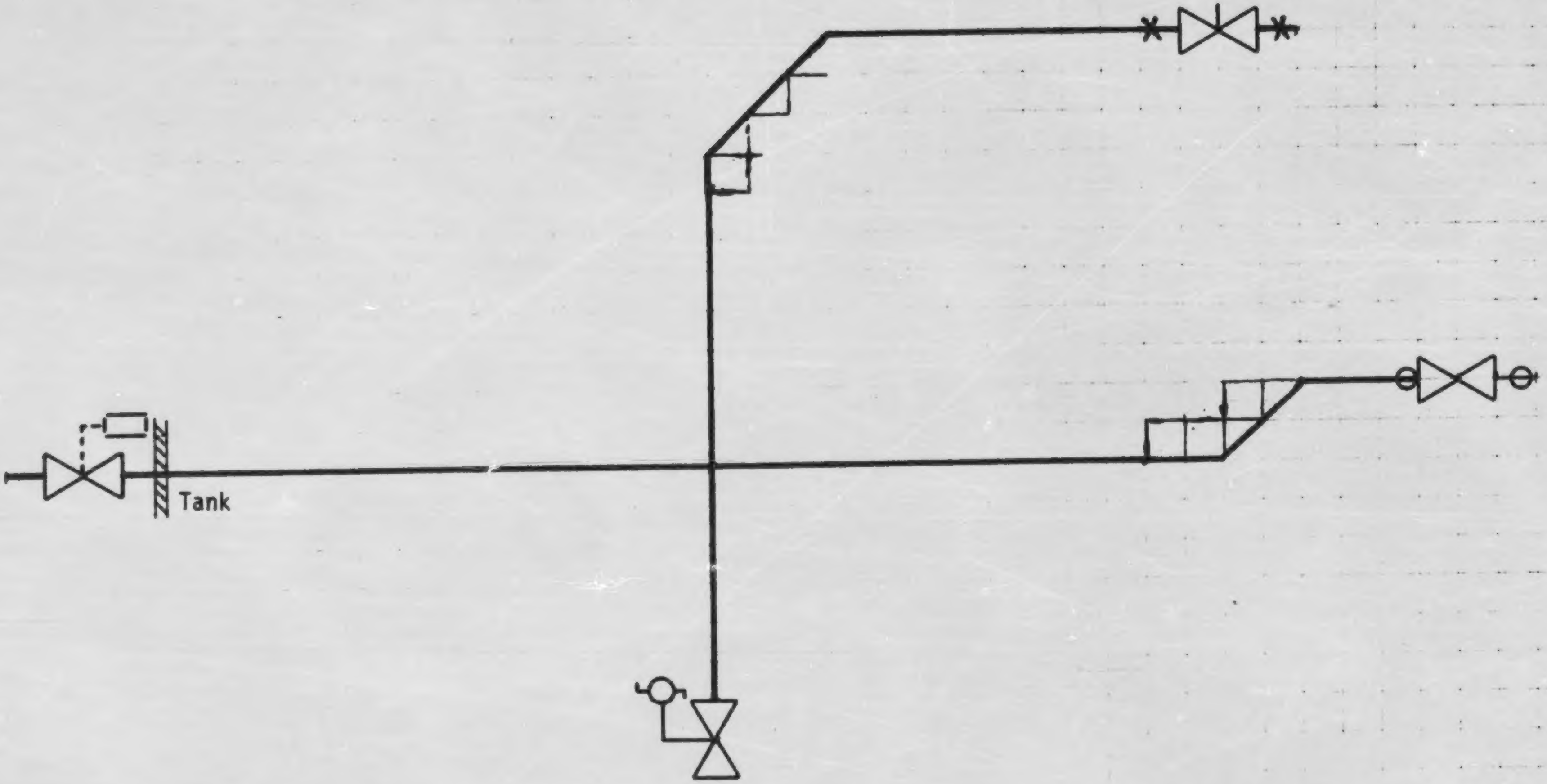
VALVE IDENTIFICATION

Directions: Select a valve from the assortment. After the number below that matches the valve number write the description and function.

Work Station Number____________________ Box Number__________________________

FITTING NUMBER	DESCRIPTION (Size, Weight, Type, Etc.)	FUNCTION (For What Used)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

VALVE ASSEMBLY



c - c measurement
Scale 1 square = 1 inch

Student: ______________________ **File Code:** 73.02.02.07.A2-2

Date: ______________________ **Date Published:** 11/21/74

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LAP TEST: VALVE NOMENCLATURE, FUNCTION AND SERVICE

1. What type of valves are usually used on supply lines to faucets to allow for repairing purposes?

   a. globe valves.
   b. compression valves.
   c. gate valves.
   d. check valves.

2. Water pressure on a compression valve should always be where?

   a. pressure position is not important.
   b. over the disc of the valve.
   c. under the disc of the valve.
   d. pressure should come from the top down in a compression valve.

3. Ground key cocks never contain which of the following?

   a. threads.
   b. washers.
   c. tee handle.
   d. tapered plug.

4. On a ground key cock the handle is in what relation to the hole in the plug?

   a. at a 45 degree angle to it.
   b. diagonal to it.
   c. at a 90 degree angle across it.
   d. parallel with it.

5. What tool would be most appropriate for turning a square head handle on a ground key cock?

   a. monkey wrench.
   b. pliers.
   c. six point socket.
   d. 10 point socket.

6. If a ground key cock has a small leak, which of the following would you try first to stop the leak?

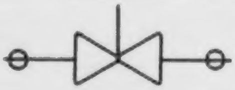
   a. loosen the handle.
   b. remove it and lubricate.
   c. tighten the nut slightly.
   d. remove and replace the valve body

7. When installing a compression valve that has a waste on it in a water supply system, how should the valve be positioned in relation to the waste location?

   a. position of the waste is not important.
   b. waste should be on the top side.
   c. waste should be on the bottom side.
   d. the waste should be placed on either side.

8. What type of joint is indicated by the symbol below?

   a. screwed.
   b. welded.
   c. soldered.
   d. glued.



9. What kind of handle is used on a compression valve?

   a. square handle.
   b. lever handle.
   c. wheel handle.
   d. tee handle.

10. What type of valve is used to release the water in the tank of a water closet?

   a. globe valve.
   b. ball cock.
   c. compression valve.
   d. flush valve.

LAP TEST ANSWER KEY: VALVE NOMENCLATURE, FUNCTION AND SERVICE

1. B
2. C
3. B
4. D
5. A
6. C
7. C
8. C
9. C
10. D

File Code: 73.02.02.08.A2-0

Date Published: 7/9/75

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Meter, Curb Cocks and Strainers

OBJECTIVES:

Express the purpose for water meters, curb cocks and strainers and recognize where they are used in the water supply systems.

EVALUATION PROCEDURE:

The succesful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

RESOURCES:

Related Information Plumbing 2, Slater.

PROCEDURE:

1. Using Related Information Plumbing 2, do the following assignments:
   a. Read about water meters, curb cocks and strainers on pages 62-65.
   b. Answer the questions on pages 65-66.
   c. Check answers with answer key.
2. Complete the LAP test.
3. Score the LAP test and return it.
4. If the test is satisfactory, begin the next assigned LAP.

   If the LAP test is unsatisfactory, proceed as the instructor directs.

Principal Author(s):

Arneson, Bundy, Frisbee

Student: ____________________ File Code: 73.02.02.08.A2-2

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LAP TEST: METER, CURB COCKS AND STRAINERS

1. To shut off the water on a curb stop, to what position do you turn the handle?

    a. parallel to the pipe.
    b. to a right angle to the pipe.
    c. 45 degree to the pipe.
    d. 0 degree to the pipe.

2. What is the advantage of an extention curb box?

    a. it has more strength than a fixed box.
    b. it may be adjusted.
    c. it has less strength than a fixed box.
    d. it requires less shoving demands than a fixed curb box.

3. Where and how should the valve in a curb box be placed?

    a. on one edge, vertically.
    b. on one edge, horizontally.
    c. in the center, upright.
    d. on either edge.

4. What would be the result if the curb stop turned after the curb box was installed?

    a. key could be turned off but not on.
    b. no problem would develop.
    c. key could be turned on but not off.
    d. key could not be turned.

5. Where should a plumber look for a water meter?

    a. near the main stack of a plumbing system.
    b. usually, where the water supply enters a dwelling.
    c. near the area floor drain.
    d. outside the house.

6. In what position should a water meter be installed?

    a. inclined.
    b. upright.
    c. horizontally.
    d. on its side.

7. How close should shutoff valves be placed in relation to a small water meter?

   a. at least 3' from the meter.
   b. within 12".
   c. valves are not needed.
   d. depends upon how many valves are needed.

8. When installing large water meters, how many (if any) valves should be installed?

   a. 0
   b. 2
   c. 1
   d. 3

9. What must be considered when installing a water meter?

   a. easy reading.
   b. distance from the curb.
   c. the distance in relation to water supply entrance.
   d. the water pressure.

10. The plumber should blow out all supply lines before installing which of the following?

    a. coupling.
    b. water meter.
    c. angle fitting.
    d. ground cock.

LAP TEST ANSWER KEY: METER, CURB COCKS AND STRAINERS

1. B
2. B
3. C
4. D
5. B
6. B
7. B
8. B
9. A
10. B

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Date Published: 7/9/75

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Service Piping and Water Main Nomenclature

OBJECTIVES:

Identify the special pipe and fittings used in providing underground water service from the source to the building.

Identify the type and size of pipe used in the building water main and express procedures for eliminating moisture condensing on the main.

Identify symbols associated with service piping.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

RESOURCES:

Related Information Plumbing 2, Slater.

PROCEDURE:

1. Using Related Information Plumbing 2, do the following assignments:
    - a. Read about the building service pipe and the basement water mains on pages 71-74.
    - b. Answer the questions on pages 74-76. Check answers with answer key.
2. Take the LAP test.
3. Score the LAP test and return it.
4. If the LAP test is satisfactory, begin the next assigned LAP.

   If the LAP test is not satisfactory, proceed as suggested by the instructor.

Principal Author(s):

Arneson, Bundy, Frisbee

Student: ______________________ File Code: 73.02.02.09.A2-2

Date: ______________________ Date Published: 11/21/74

Mountain-Plains Education &
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LAP TEST: SERVICE PIPING & WATER MAIN NOMENCLATURE

1. Where would you look in a basement for the valve to shut off all the water for the entire house?
   - a. near the water heater.
   - b. near the water softener.
   - c. where the service pipe enters the house.
   - d. near the house drain.

2. What type(s) of valve(s) are used on service pipes in the house?
   - a. check.
   - b. globe.
   - c. compression or gate.
   - d. ball cock.

3. If a leak occured in the service pipe under the valve in the basement, where would you shut off the water.
   - a. at the entrance of the service pipe into the house.
   - b. at the water meter valve.
   - c. at the curb cock.
   - d. at the main supply pipe for the city block.

4. What tool is used to shut the water off in a service pipe?
   - a. stop key.
   - b. pipe wrench.
   - c. monkey wrench.
   - d. wheel.

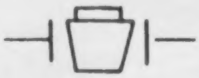
5. How would a plumber find the house service pipe in a dwelling?
   - a. call the city engineer.
   - b. trace it from where it enters.
   - c. use a metal detector.
   - d. locate it by finding the floor drain.

6. What precaution must be taken when installing a large, over 2" house drain?
   - a. use type L copper.
   - b. use type M copper.
   - c. do not use tarred oakum.
   - d. do not use soft IPT.

7. When comparing galvanized pipe to copper pipe, what must be considered?
   - a. comparison depends on the particular application or use.
   - b. a large copper pipe than galvanized pipe must be installed to do the same job.
   - c. they are equal.
   - d. a larger galvanized pipe than copper pipe must be installed to do the same job.

8. Due to corrosion, in approximately ten years friction will double in what type or kind of pipe?
   - a. type of copper.
   - b. galvanized.
   - c. type M copper.
   - d. type L copper.

9. What type of joint is indicated in the symbol below?
   - a. soldered.
   - b. welded.
   - c. screwed.
   - d. flanged.



10. How can galvanized pipes be stopped from sweating?
    - a. cover with air cell covering and paint.
    - b. wipe the pipes with cloth.
    - c. replace with copper pipe.
    - d. apply a cellulose covering.

LAP TEST ANSWER KEY: SERVICE PIPING & WATER MAIN NOMENCLATURE

1. C
2. C
3. C
4. A
5. B
6. C
7. D
8. B
9. C
10. A

File Code: 73.02.02.10.A2-0

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Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Water and Hydrostatic Pressure

OBJECTIVES:

Express the meaning of water and hydrostatic pressure and solve problems with these pressures.

Relate the cause of water hammer and the application of the air chamber to relieve the shock in the water system caused by water hammer.

Identify the operation and use of pressure gauges.

EVALUATION PROCEDURE:

Related Information Plumbing 1, Slater.

Related Information Plumbing 2, Slater.

PROCEDURE:

1. Using Related Information Plumbing 1, do the following assignments:
    a. Read about pressure gauges on pages 102 and 103.
    b. Answer the questions and make requested sketch on pages 104-105. Check answers with answer key.
2. Using Related Information Plumbing 2, do the following assignments:
    a. Read about water pressure, hydrostatic pressure and water hammer on pages 77-81.
    b. Answer the questions on pages 82-83. Check answers with answer key.
3. Take the LAP test.
4. Score the LAP test and return it.
5. If the LAP test is satisfactory, begin the next assigned LAP.

   If the LAP test is unsatisfactory, proceed as the instructor suggests.

Principal Author(s):

Areson, Bundy Frisbee

Student: ______________________ **File Code:** 73.02.02.10.A2-2

Date: ______________________ **Date Published:** 11/21/74

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LAP TEST: WATER AND HYDROSTATIC PRESSURE

1. On the first floor of a building there is 65 pounds of pressure on the plumbing supply system. How much pressure is on the second floor, fifteen feet above?

   a. 71.51.lbs.
   b. 58.49 lbs.
   c. 64.566 lbs.
   d. 55.49 lbs.

2. What type of pressure gauge would you use on a vapor heating system?

   a. micrometer.
   b. altitude gauge.
   c. pressure gauge.
   d. vacuum gauge.

3. When a pressure gauge that is installed on a system reads 30 lbs., what does this really mean?

   a. 30 lbs. pressure against every 10 square inches of exposed area in the system.
   b. 30 lbs. pressure against the total exposed area of the system.
   c. 30 lbs pressure against every square inch of exposed area in the system.
   d. 30 lbs. pressure against every 100 square inches of exposed area in the system.

4. The Bourden principle is best demonstrated in which of the following?

   a. pressure gauge.
   b. valve.
   c. water pipe.
   d. flexible coupling.

5. The principle that states that pressure tends to straighten hose is best demonstrated in which of the following?

   a. pipe wrench.
   b. valve.
   c. pressure gauge.
   d. faucet.

6. If a gauge reads 12 inches of mercury, what type of gauge is it?

   a. altitude gauge.
   b. pressure.
   c. vacuum gauge.
   d. micrometer.

7. If a gauge reads 12 inches of mercury, how many pounds of pressure is that equal to in the negative sense?

   a. -6 lbs.
   b. -12 lbs.
   c. -24 lbs.
   d. -36 lbs.

8. Which type of heating system requires a syphon trap if a gauge is to be installed on the system?

   a. forced air oil.
   b. forced air gas.
   c. steam.
   d. electric forced air.

9. How much will thirty pounds of pressure raise water in a pipe (approximately)?

   a. .434 feet.
   b. 69.3 feet.
   c. 30 feet.
   d. 30 inches.

10. Which of the following is the least compressable?

   a. freon 22.
   b. freon 11.
   c. air.
   d. water.

LAP TEST ANSWER KEY: WATER AND HYDROSTATIC PRESSURE

1. B
2. D
3. C
4. A
5. C
6. C
7. C
8. C
9. B
10. D

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File Code: 73.02.02.11.A2-0

Date Published: 7/10/75

Learning Activity Package

Student:

Date:

PERFORMANCE ACTIVITY: Friction Loss Calculation

OBJECTIVES:

Given water system information and a flow friction loss table, solve stated problems that include friction loss.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

RESOURCES:

Related Information Plumbing 2, Slater.

PROCEDURE:

1. Using Related Information Plumbing 2, do the following assignments:
    a. Read about friction loss in pipes and friction loss of head on pages 84-87.
    b. Answer the questions on pages 87-88.
    c. Check answers with the answer key.
2. Take the LAP test.
3. Score the LAP test and return it.
4. If the LAP test is satisfactory, begin the next assigned LAP.

    If the LAP test is unsatisfactory, proceed as the instructor suggests.

Principal Author(s):

Arneson, Bundy, Frisbee

Student: ______________________ **File Code:** 73.02.02.11.A2-2

Date: ______________________ **Date Published:** 11/21/74

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LAP TEST: FRICTION LOSS CALCULATION

1. Figure the frictional loss in the water supply system shown below: Compute for 10 G.P.M. flow. (Friction chart is on page 2)

   a. 16.5
   b. 37.9
   c. 43.4
   d. 26.9

Diagram 24

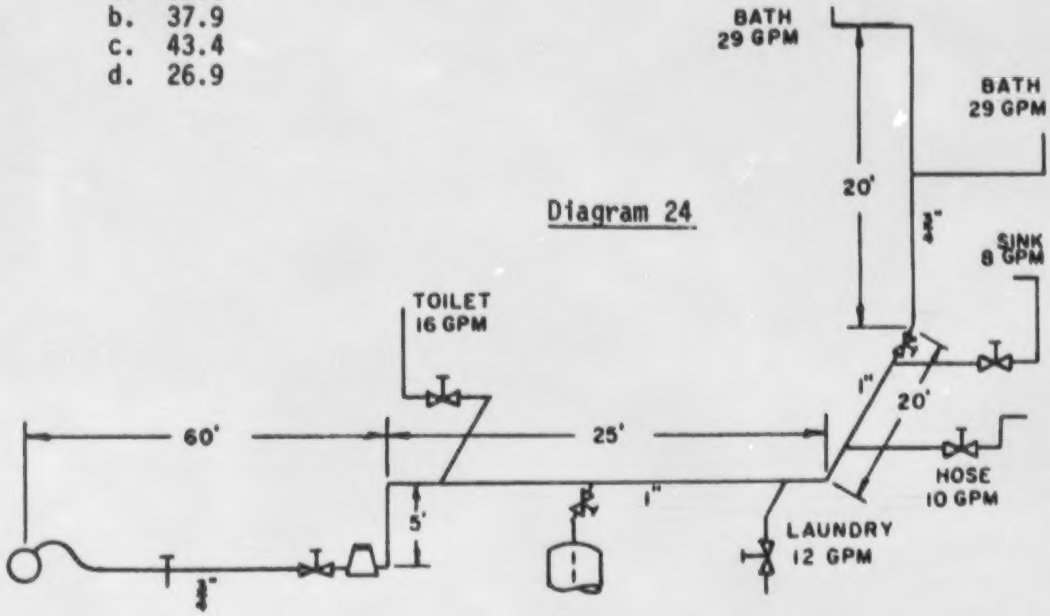
BATH
29 GPM
BATH
29 GPM
20'
$\frac{3}{4}$"
SINK
8 GPM
TOILET
16 GPM
60'
25'
1"
20'
1"
HOSE
10 GPM
5'
LAUNDRY
12 GPM
$\frac{3}{4}$"

Diagram 25

Flow in G.P.M.	Friction Loss in lbs Per Sq. In.per 100 ft. of Iron Pipe					
	1/2	3/4	1	1 1/4	1 1/2	2
1	0.9	0.2				
2	3.2	0.8				
3	6.9	1.8	0.6			
4	11.7	3.2	0.9	0.3	0.1	
5	17.8	4.5	1.4	0.3	0.2	
6	24.8	6.4	2.0	0.5	0.3	0.1
8	42.6	10.9	3.4	0.9	0.4	0.1
10	64.	16.5	5.1	1.4	0.6	0.2
12		25.1	7.1	1.9	0.9	0.3
14		30.4	9.6	2.5	1.2	0.4
16		40.	12.2	3.2	1.5	0.5
18		48.	15.2	4.0	1.8	0.7
20		59.	18.	5.	2.3	0.8
30			38.	10.2	4.8	1.7
40			66.	12.8	8.2	3.0
50				28.	13.4	4.3

2. When considering friction loss, what effect do burrs have on water flow? They cause which of the following?

   a. eddies causing friction.
   b. cause fitting leaks.
   c. cause fitting irregularities.
   d. cause corrosion on copper pipe.

3. Figure the friction loss in a 1" galvanized steel pipe 125' long and supplying four 1/2" faucets, with a flow at each faucet of 5 gallons per minute.

   a. 14.3 lbs.
   b. 17.2 lbs.
   c. 22.5 lbs.
   d. 29.2 lbs.

4. What is the friction loss in pounds in a 1 inch pipe 100 feet long with a velocity of 20 gallons per minute?

   a. 59 lbs. per 100' of pipe.
   b. 18 lbs. per 100' of pipe.
   c. 5 lbs. per 100' of pipe.
   d. 38 lbs. per 100' of pipe.

5. The flow in iron pipe will be decreased by what % in 15 years?

   a. 50-75%
   b. 10-15%
   c. 25-50%
   d. 33 1/3-66 2/3%

6. A 1/2" water main 150 feet long, with 45 pounds pressure, fails to supply fixtures at the rate of 8 gallons per minute. How could this be remedied?

   a. change the supply pipe to 1".
   b. change water main.
   c. water pressure should be decreased.
   d. change supply pipe to 3/4".

7. Give the friction loss in 185' of 1/2" pipe with flow of 8 G.P.M. Suppose in this case that only 25 pounds pressure is available. What should be done to assure the flow required?

   a. replace with 1" pipe.
   b. replace with 3/8" pipe.
   c. replace with 1/2" gal. pipe.
   d. replace with 3/4" gal. pipe.

8. A 2" water main extends 1,000' to supply a tank 10' x 15' x 6'. At the rate of 12 G.P.M. what is the friction loss?

   a. 3.9 lbs.
   b. 3 lbs.
   c. .03 lbs.
   d. 39 lbs.

9. A 2" water main extends 1,000' to supply a tank 10' x 15' x 6' at the rate of 12 G.P.M. How long will it take to fill the tank?

   a. 5.6 hours.
   b. 56 minutes.
   c. 562.5 minutes.
   d. 5625 seconds.

10. On a line of pipe 125' long, six faucets, each discharging 5 G.P.M., are installed. What is the minimum pressure at the main and what size pipe is required? The pressure at the faucet is 15 pounds per inch.

    a. 2" pipe, 137.5 lbs.
    b. 1 1/4" pipe, 27.74 lbs.
    c. 1/2" pipe, 39.2 lbs.
    d. 3/4" pipe 48.5 lbs.

LAP TEST ANSWER KEY: FRICTION LOSS CALCULATION

1. D
2. A
3. C
4. B
5. C
6. D
7. A
8. B
9. C
10. B

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Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Water Sources and Solvency

OBJECTIVES:

Identify various sources of water and characteristics of the water from particular sources.

Recognize those characteristics of water that have an effect on the plumbing system.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

RESOURCES:

Related Information Plumbing 2, Slater.

PROCEDURE:

1. Using Related Information Plumbing 2, do the following assignments:
   - a. Read about water sources and water solvency on pages 89-91.
   - b. Answer the questions on pages 91-93.
   - c. Check answers with the answer key.
2. Take the LAP test.
3. Score and return the LAP test.
4. If the LAP test is satisfactory, begin the next assigned LAP.

   If the LAP test is unsatisfactory, proceed as directed by the instructor.

Principal Author(s):

Arneson, Bundy, Frisbee

Student: ______________________ File Code: 73.02.02.12.A2-2

Date: ______________________ Date Published: 11/21/74

Mountain-Plains Education &
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LAP TEST: WATER SOURCES AND SOLVENCY

1. Waterbearing strata vary in depth from:

   a. 1' to 250'.
   b. 2" to 500'.
   c. 6' to 1500'.
   d. 3' to 1000'.

2. Generally, waterbearing strata will:

   a. run perpendicular to land contours.
   b. run diagonally across land contours.
   c. follow the contour of the land.
   d. run in any direction.

3. What is the chemical symbol for water:

   a. HON
   b. H_2O
   c. N_3O
   d. C_2ONH_4X

4. At atmospheric pressure (about 15 lbs.), water will absorb up to:

   a. 4% of its volume.
   b. 10% of its volume.
   c. 2% of its volume.
   d. 8% of its volume.

5. How many feet away from any possible contamination source should a drinking well be located?

   a. at least 500 feet.
   b. at least 50 feet.
   c. at least 200 feet.
   d. at least 100 feet.

6. A deep well is one which is:

   a. over 100' deep.
   b. under 25' deep.
   c. over 50' deep.
   d. over 30' deep.

7. Why are most city reservoirs located on a hill?
   - a. to improve the process of water purification.
   - b. to increase the atmospheric pressure in the reservoir.
   - c. to decrease the atmospheric pressure in the reservoir.
   - d. gravity fed.

8. What is the meaning of evaporation?
   - a. the slow passage of water to air.
   - b. the rapid passage of air to water.
   - c. the slow passage of air to water.
   - d. the rapid passage of water to the ground.

9. What kind of pipe is the most dangerous to use as a water supply?
   - a. brass.
   - b. copper.
   - c. iron.
   - d. lead.

10. What happens to most of the rainfall?
    - a. it evaporates into the air.
    - b. it runs to the rivers.
    - c. it settles into the ground.
    - d. it disappears to unknown sources.

LAP TEST ANSWER KEY: WATER SOURCES AND SOLVENCY

1. D
2. C
3. B
4. A
5. D
6. D
7. D
8. A
9. D
10. B

Student: ______________________ File Code: 73.02.02.00.B2-2

Date: ______________________ Date Published: 11/18/74

Mountain-Plains Education &
Economic Development
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Glasgow AFB, Montana 59231

UNIT POST TEST: COLD WATER SUPPLY

73.02.02.01

1. Hard copper tubing is available in:
   - a. 30' lengths.
   - b. 10' lengths.
   - c. 20' lengths.
   - d. 15' lengths.

2. Type "K" copper tubing is furnished in:
   - a. 20' lengths.
   - b. 60' coils.
   - c. 40' coils.
   - d. 30 lengths.

3. Which type of copper tubing has a thin wall and is used for general plumbing and heating, but not underground?
   - a. type "K".
   - b. type "M".
   - c. type "N".
   - d. type "L".

4. How many revolutions should be made around the copper tubing with the tubing cutter before setting the cutter wheel a little deeper?
   - a. 2
   - b. 3
   - c. 4
   - d. 1

5. What is the weight in pounds of a 60' coil of 3/4" type K copper tubing? (Use the table on page 2)
   - a. 384.60 lbs.
   - b. 0.641 lbs.
   - c. 6.41 lbs.
   - d. 38.460 lbs.

Diagram 14

SIZES AND WEIGHTS OF COPPER WATER TUBE

(In accordance with Simplified Practice Recommendation R217–46)

Standard Water Tube Size	Actual Outside Diameter	Nominal Wall Thickness			Theoretical Weight		
		Type K	Type L	Type M	Type K	Type L	Type M
Inches	Inches	Inches	Inches	Inches	Lb./Ft.	Lb./Ft.	Lb./Ft.
⅜	0.500	0.049	0.035	.....	0.269	0.198	.....
½	.625	.049	.040	.....	.344	.285	.....
⅝	.750	.049	.042	.....	.418	.362	.....
¾	.875	.065	.045	.....	.641	.455	.....
1	1.125	.065	.050	.....	.839	.655	.....
1¼	1.375	.065	.055	.....	1.04	.884	.....
1½	1.625	.072	.060	.....	1.36	.114	..
2	2.125	.083	.070	.....	2.06	1.75	.....
2½	2.625	.095	.080	0.065	2.93	2.48	2.03
3	3.125	.109	.090	.072	4.00	3.33	2.68
3½	3.625	.120	.100	.083	5.12	4.29	3.58
4	4.125	.134	.110	.095	6.51	5.38	4.66
5	5.125	.160	.125	.109	9.67	7.61	6.66
6	6.125	.192	.140	.122	13.9	10.2	8.92
8	8.125	.271	.200	.170	25.9	19.3	16.5
10	10.125	.338	.250	.212	40.3	30.1	25.6
12	12.125	.405	.280	.254	57.8	40.4	36.7

73.02.02.02

6. What is the method used to join copper tubing without using a coupling?

   a. swaging.
   b. soldering.
   c. welding.
   d. epoxying.

7. Swaging is predominantly used on which of the following types of pipe?

   a. black cast iron.
   b. galvanized iron.
   c. copper.
   d. galvanized steel.

8. After each tap the swaging tool should be:

   a. turned slightly.
   b. removed from the tubing.
   c. lubricated with light machine oil.
   d. cleaned with emery cloth.

9. Which of the following hammers are recommended for use when swaging copper tubing:

   a. ball peen.
   b. claw hammer.
   c. fiberglass - head hammer.
   d. 16 oz. stanley ripping hammer.

10. When swaging copper tubing, which of the following tools should be used to hold the tubing?

    a. channel lock pliers.
    b. vice.
    c. vice grip pliers.
    d. flaring block.

73.02.02.03

11. When heating a joint, only enough heat should be applied to:

    a. char the flux.
    b. burn the flux.
    c. melt the solder.
    d. lightly warm the tubing.

73.02.02.03 (continued)

12. To cut the end of a copper tubing squarely, which of the following tools should be used?

    a. hacksaw with 20 teeth per inch.
    b. tube cutter.
    c. reamer.
    d. sabre saw.

13. What is the result if a burr is not removed from a piece of copper tubing about to be soldered?

    a. reduces the flow of water.
    b. inhibits a good solder joint.
    c. will cause a cold solder joint.
    d. prevents a uniform fit of the two pieces of tubing.

14. Why should the surfaces of all tubing be cleaned just before solding?

    a. keeps oxidations of metal to a minimum.
    b. helps the copper tubing to shine; thereby making the overall job more attractive.
    c. assists the flow of water.
    d. saves time; prevents the plumber from cleaning them later.

15. Before soldering the copper tubing, interior and exterior surfaces should be cleaned with which of the following?

    a. sand paper.
    b. file.
    c. cleaning tool or steel wool.
    d. crocus cloth.

73.02.02.04

16. Which of the following would properly identify a copper angle fitting that is to be attached to a section of iron pipe?

    a. 3/4" IPT to 1/2" copper.
    b. 1/2" IPT to 1/2" copper.
    c. 1/2" copper to 1/2" IPT.
    d. 3/4" IPT to 1/2" copper.

17. Solder flows into a joint by which of the following?

    a. gravity flow.
    b. capillary action.
    c. osmosis.
    d. pressure.

73.02.02.04 (continued)

18. Which of the following specifies a fitting which could be used with a 1" galvanized iron pipe to extend two 3/4" soft copper tubes at 90° in opposite directions?

    a. 1" IPT to 3/4" copper to 3/4" copper flared tee.
    b. 3/4" copper to 3/4" copper to 1" IPT flared tee.
    c. 3/4" copper to 1" IPT to 3/4" copper flared tee.
    d. 1/2" IPT to 3/4" copper to 1/2" copper flared tee.

19. A flared copper tube fitting is similar to which of the following galvanized iron fittings?

    a. 3/4" IPT 90° ell.
    b. bull head tee.
    c. ground joint union.
    d. 1/2" x 1/2" x 3/8" IPT tee.

20. Two 1/2" copper lines are to be extended from the end of a 3/4" galvanized iron pipe line. What fitting would be used?

    a. 1/2" copper to 1/2" IPT to 3/4" IPT tee.
    b. 1/2" IPT to 3/4" copper to 1/2" copper tee.
    c. 3/4" copper to 1/2" IPT to 3/4" copper tee.
    d. 3/4" IPT to 1/2" copper to 1/2" copper tee.

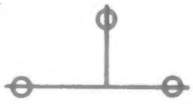
73.02.02.05

21. Branch fittings are basically:

    a. wyes and elbows.
    b. elbows and crosses.
    c. wyes and tees.
    d. crosses and tees.

22. What type of joint is used on this fitting symbol?

    a. soldered.
    b. welded.
    c. screwed.
    d. flanged.



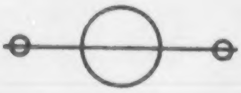
23. When making a solder joint using a branch fitting, the source of heat (torch) should be:

    d. directed in the direction of solder flow.
    b. held in one position.
    c. be directed to the inside of the fitting.
    d. kept moving to distribute the heat.

73.02.02.05 (continued)

24. What fitting is indicated by this symbol?

    a. tee.
    b. elbow.
    c. Y branch.
    d. coupling.



25. What type of joint is indicated by the symbol in question 24.

    a. screwed.
    b. welded.
    c. soldered.
    d. flanged.

73.02.02.06

26. Which of the following sweat fittings is used to close off the end of a copper tube?

    a. crossover.
    b. plug fitting.
    c. cap fitting.
    d. reducing coupling.

27. Which of the following sweat fittings is used to connect a copper pipe to a fitting that was made to take a different size copper pipe?

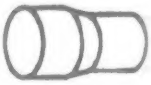
    a. female adapter.
    b. sweat bushing.
    c. male adapter.
    d. fitting reducer.

28. To eliminate water hammer, a plumber should install a:

    a. air chamber.
    b. female adapter.
    c. union.
    d. bushing.

29. Identify the illustration below:

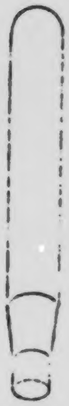
    a. crossover.
    b. flexible coupling.
    c. fitting reducer.
    d. union.



73.02.02.06 (continued)

30. Identify the type of sweat fitting illustrated below:

    a. union.
    b. fitting reducer.
    c. air chamber.
    d. plug fitting.



73.02.02.07

31. What sizes do compression valves come in?

    a. 3/8", 1/2", 3 4"
    b. 1/4", 3/8", 1/2"
    c. 1/2", 3/4", 1"
    d. 1", 2", 3"

32. Which of the following valves is similar to the compression valve but is of heavier construction?

    a. globe valve.
    b. ground cock.
    c. check valve
    d. gate valve.

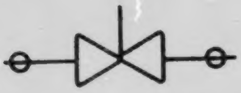
33. When installing a compression valve that has a waste on it in a water supply system, how should the valve be positioned in relation to the waste location?

    a. position of the waste is not important.
    b. waste should be on the top side.
    c. waste should be on the bottom side.
    d. the waste should be placed on either side.

73.02.02.07 (continued)

34. What is indicated by this symbol?

    a. check valve.
    b. globe valve.
    c. gate valve.
    d. ground cock.



35. What type of joint is indicated by the symbol in question 34?

    a. screwed.
    b. welded.
    c. soldered.
    d. glued.

73.02.02.08

36. To shut off the water on a curb stop, to what position do you turn the handle?

    a. parallel to the pipe.
    b. to a right angle to the pipe.
    c. 45^0 to the pipe.
    d. 0^0 to the pipe.

37. What is the advantage of an extention curb box?

    a. it has more strength than a fixed box.
    b. it may be adjusted.
    c. it has less strength than a fixed box.
    d. it requires less shoring demands than a fixed curb box.

38. What effect on water flow do meters have?

    a. they cause friction.
    b. they regulate water flow.
    c. they regulate water pressure.
    d. they determine water solvency.

39. What must be considered when installing a water meter?

    a. easy reading.
    b. distance from the curb.
    c. the distance in relation to water supply entrance.
    d. the water pressure.

73.02.02.08 (continued)

40. When is the one-foot dial used?

    a. when testing water meters.
    b. when testing water pressure.
    c. when testing water solvency.
    d. when determining water hardness.

73.02.02.09

41. What type(s) of valve(s) are used on service pipes in the house?

    a. check.
    b. globe.
    c. compression or gate.
    d. ball cock.

42. What kind and type of pipe is used for service?

    a. type L soft.
    b. type K hard.
    c. type K soft.
    d. type L hard.

43. If you located a curb box in front of a property, where would you find the corporation ferrule?

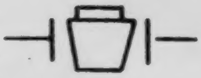
    a. in the water main in front of the curb cock.
    b. just prior to entering the house.
    c. in the house.
    d. near the water meter.

44. Due to corrosion, in approximately ten years friction will double in what type or kind of pipe?

    a. type K copper.
    b. galvanized.
    c. type M copper.
    d. type L copper.

45. What is indicated by this symbol?

    a. curb box.
    b. stop cock.
    c. water meter.
    d. water main.



73.02.02.10

46. If a 1" x 1" x 12" column of water weighs .434 pounds, what is the weight of one cubic inch?

    a. 5.208 lbs.
    b. .036 lbs.
    c. .069 lbs.
    d. 1.525 lbs.

47. What pressure is exerted per square inch on a swimming pool that is 9 feet deep at the deep end?

    a. 9 lbs.
    b. 4.507 lbs.
    c. 3.906 lbs.
    d. .434 lbs.

48. How many inches of mercury equal one pound of negative pressure?

    a. two.
    b. one.
    c. ten.
    d. .5

49. Which of the following would cause the most shock to a plumbing system?

    a. globe.
    b. compression.
    c. self closing faucet.
    d. gate.

50. How would you eliminate water hammer in a system?

    a. install a bypass.
    b. install a rapid self closing faucet.
    c. install heavier pipe.
    d. install a shock absorber.

73.02.02.11

51. What type of pipe would you select for water piping?

    a. glass pipe.
    b. steel pipe.
    c. galvanized pipe.
    d. copper tubing.

73.02.02.11 (continued)

52. What is the loss in pounds in 1/2" pipe with a flow of 1 gallon per minute. (Refer to the friction chart below.)

   a. 11.7 lbs. per 100 feet.
   b. .2 lbs. per 100 feet.
   c. 64 lbs. per 100 feet.
   d. .9 lbs. per 100 feet.

Diagram 25

Flow in G.P.M.	Friction Loss in lbs Per Sq. In.per 100 ft. of Iron Pipe					
	1/2	3/4	1	1 1/4	1 1/2	2
1	0.9	0.2				
2	3.2	0.8				
3	6.9	1.8	0.6			
4	11.7	3.2	0.9	0.3	0.1	
5	17.8	4.5	1.4	0.3	0.2	
6	24.3	6.4	2.0	0.5	0.3	0.1
8	42.6	10.9	3.4	0.9	0.4	0.1
10	64.	16.5	5.1	1.4	0.6	0.2
12		25.1	7.1	1.9	0.9	0.3
14		30.4	9.6	2.5	1.2	0.4
16		40.	12.2	3.2	1.5	0.5
18		48.	15.2	4.0	1.8	0.7
20		59.	18.	5.	2.3	0.8
30			38.	10.2	4.8	1.7
40			66.	12.8	8.2	3.0
50				28.	13.4	4.3

53. The loss of water pressure that is due to the action of moving water against the sides of the pipe is called:

   a. friction loss.
   b. friction gain.
   c. gravity flow.
   d. dissipation of water due to heat.

73.02.02.11 (continued)

54. Which of the following illustrations displays the least amount of friction loss?

    a. use Fig. 5.
    b. use Fig. 2.
    c. use Fig. 4
    d. use Fig. 3

Diagram 26

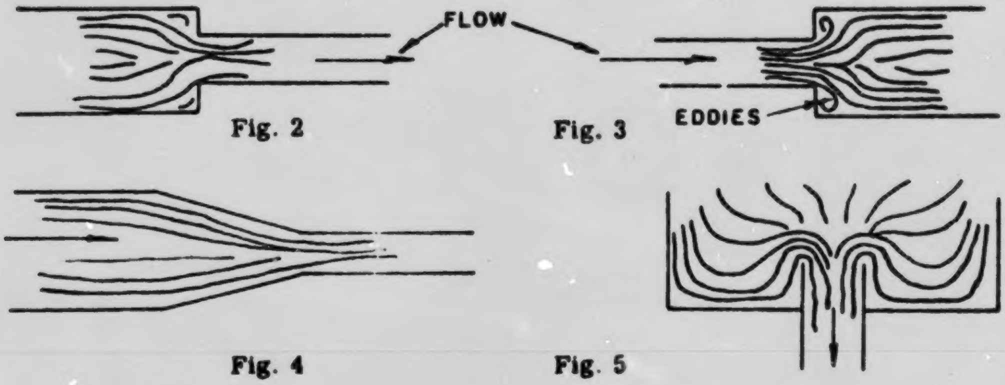


Fig. 2

Fig. 3

Fig. 4

Fig. 5

55. Give the friction loss at the rear of a basement under the following conditions; the flow is 10 G.P.M., the 1/2" pipe rises 5' - 6" to the ceiling, extends across the ceiling 7' - 6" to center and 27' to the rear wall.

    a. 25.8 lbs.
    b. 39.2 lbs.
    c. 36.7 lbs.
    d. 19.5 lbs.

73.02.02.12

56. Why is the water in lakes and rivers generally impure?

    a. exposed to too much atmospheric pressure.
    b. when running over the ground, it picks up all sorts of impurities.
    c. exposed to too little atmospheric pressure.
    d. the lack of surface water movement.

57. How many and what types of gases make up water?

    a. three - oxygen, hydrogen, and nitrogen.
    b. two - hydrogen and oxygen.
    c. two - oxygen and nitrogen.
    d. four - carbon dioxide, nitrogen, hydrogen, and argon.

73.02.02.12 (continued)

58. Which of the following best defines the term "hard water"?

    a. water which contains many minerals.
    b. water which is approaching its freezing point (formation of ice crystals).
    c. water which contains no minerals.
    d. chemically treated water.

59. How many parts lead per million parts of water constitutes a poisonous mixture?

    a. 1
    b. .5
    c. 3
    d. 25

60. What happens to most of the rainfall?

    a. it evaporates into the air.
    b. it runs to the rivers.
    c. it settles into the ground.
    d. it disappears to unknown sources.

UNIT TEST ANSWER SHEET

POST TEST

Occupational Area: ______________________
File Code: 73.02.02.00.B2-2
Name: ______________________

ANSWERS

73.02.02.01	1.	C	73.02.02.05	21.	C	73.02.02.09	41.	C
	2.	B		22.	A		42.	C
	3.	D		23.	D		43.	A
	4.	A		24.	A		44.	B
	5.	D		25.	C		45.	B
.02.02.02	6.	A	73.02.02.06	26.	C	73.02.02.10	46.	B
	7.	C		27.	D		47.	C
	8.	A		28.	A		48.	A
	9.	A		29.	C		49.	C
	10.	D		30.	C		50.	D
73.02.02.03	11.	C	73.02.02.07	31.	A	73.02.02.11	51.	D
	12.	B		32.	A		52.	D
	13.	A		33.	C		53.	A
	14.	A		34.	B		54.	D
	15.	C		35.	B		55.	A
73.02.02.04	16.	C	73.02.02.08	36.	B	73.02.02.12	56.	B
	17.	B		37.	B		57.	B
	18.	B		38.	A		58.	A
	19.	C		39.	A		59.	B
	20.	D		40.	A		60.	B

Student: ____________________ File Code: 73.02.02.00.A1-5 and 73.02.03.00.A1-5

Date: ____________________ Date Published: 11/13/74

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Family Pay Number: __________ Sex: M F (Circle 1)

UNIT PERFORMANCE TEST: COLD AND HOT WATER

OBJECTIVE 1:

Given a floor plan, the student will draw the hot and cold supply system for a kitchen and utility room in a residential dwelling, using copper pipe and fittings.

OBJECTIVE 2:

Given a floor plan, the student will lay out the hot and cold supply system for a kitchen and utility room in a residential dwelling using copper pipe and fittings.

OBJECTIVE 3:

Given a floor plan, the student will assemble the hot and cold supply system for a kitchen and utility room in a residential dwelling using copper pipe and fittings.

TASK:

Having a floor plan, the student will lay out and assemble a supply system, both hot and cold, for a kitchen and utility room in a typical residence using copper pipe and fittings.

ASSIGNMENT:

CONDITIONS:

The student will be supplied with the necessary tools and equipment to complete the job. He may use any reference material available. No assistance will be obtained from other students or the instructor.

RESOURCES:

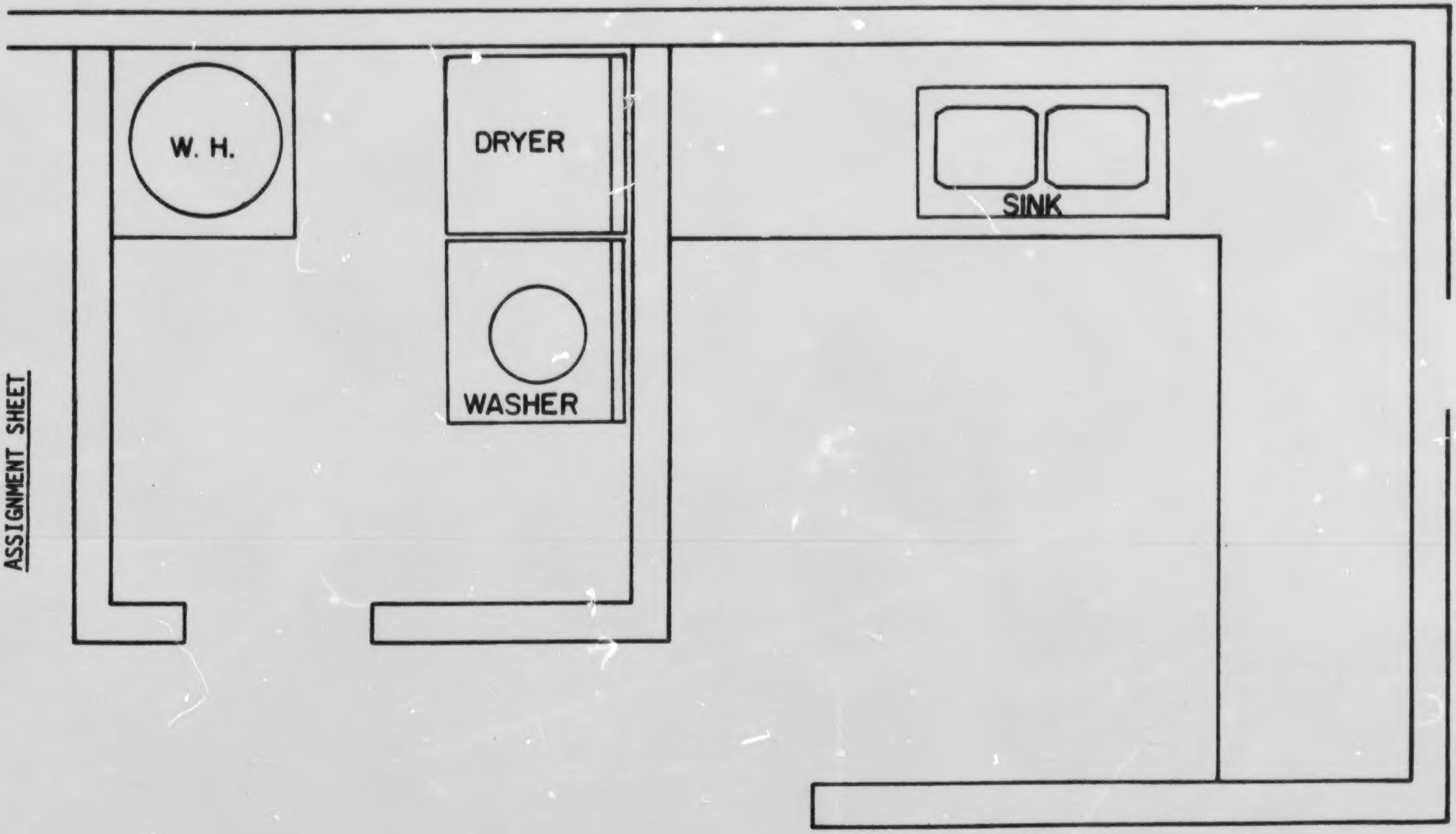
1. Printed materials:

    Montana State Plumbing Code.
    Related information: Plumbing I and II, Harry Slater
    Audels Plumbers and Pipe Fitters library materials

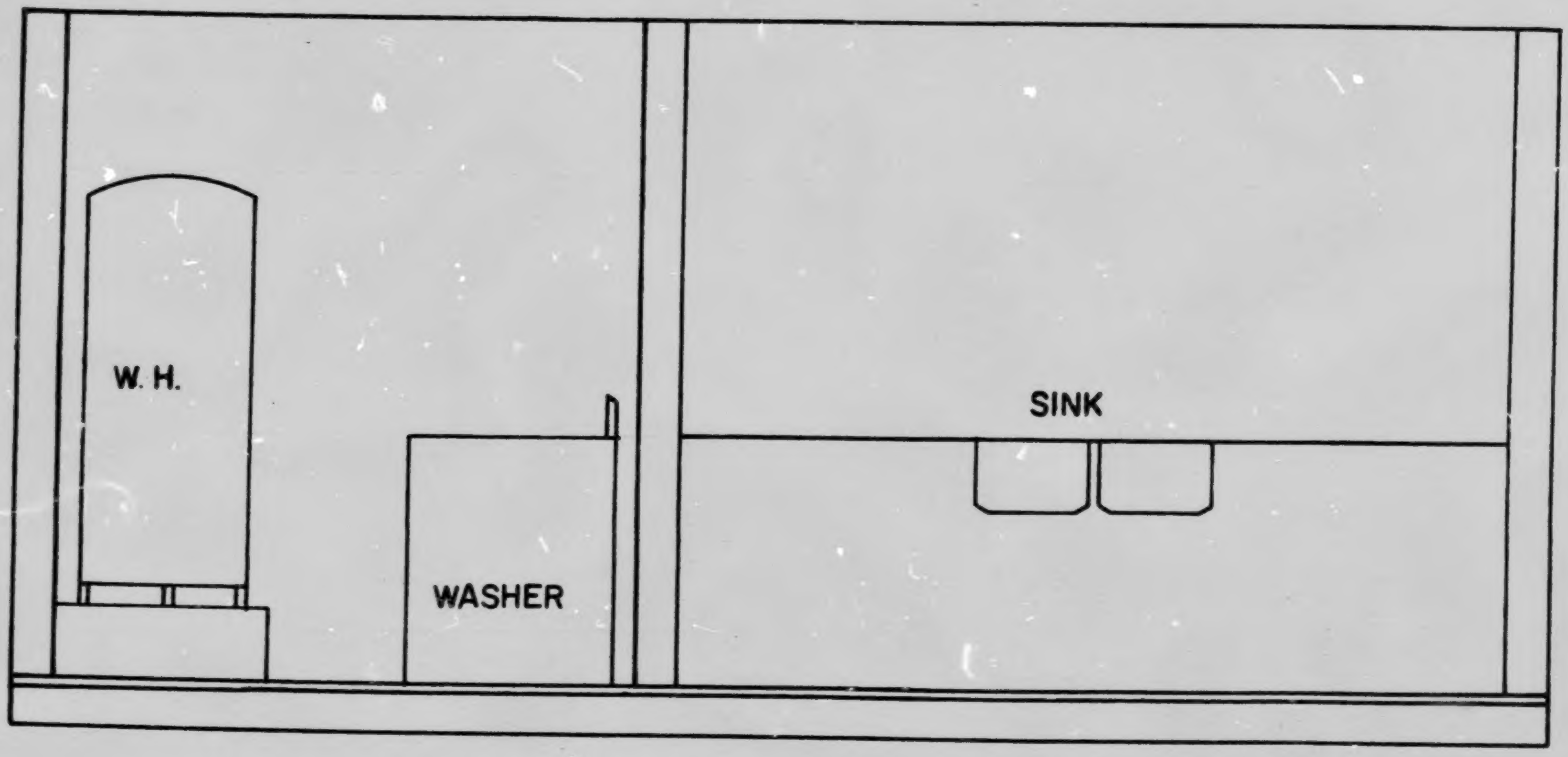
2. Equipment:

    Typical hand tools (hammer, screwdriver, pliers, etc.)
    Pipe threader
    Pipe cutter
    Soil pipe cutter
    Lead Pot
    Lead Furnace
    Ladel
    Caulking irons
    Rulers, tapes, calipers
    Plastic pipe cutter
    Presto Lite torch and tank
    Copper pipe and fittings

ASSIGNMENT SHEET


W. H.
DRYER
WASHER
SINK

203


W. H.
WASHER
SINK

205

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Student: ____________________

File Code: 73.02.02.00.A1-5 and 73.02.03.00.A1-5

Date: ____________________

Date Published: 11/13/74

Family Pay Number: ____________ Sex: M F (Circle 1)

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Drawing is neat.		
Criterion: It is readable.		
2. Drawing is accurate.		
Criterion: a. It conforms to State Plumbing Code.		
b. Conforms to the floor plan.		
Objective 2:		
3. Pipe and fittings are appropriate.		
Criterion: State Plumbing Code.		
4. Measurements are accurate.		
Criterion: To ± ¼" of plan.		
Objective 3:		
5. Uses appropriate tools, equipment and procedure.		
Criterion: a. Manufacturer's directions.		
b. Hand Tools, Westinghouse Learning Corp.		

	CRITERION	
	Met	Not Met
6. Follows safe practices and procedures.		
Criterion: OSHA.		
7. Assembly is neat and presentable.		
Criterion: a. State Plumbing Code.		
b. Work is plumb and square.		
c. Meets Building Codes.		
8. System functions properly.		
Criterion: No leaks by water or air test to 80 pounds.		
9. Completes the job in a reasonable amount of time.		
Criterion: 8 hours.		
Student must complete 7/8 of all line items, except number		
8 must be satisfactory to pass test.		

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

File Code: 73.02.03.02.A2-0
Date Published: 7/15/75

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Flare and Compression Fittings

OBJECTIVES:

Identify flare fittings by size and name.

Identify the purpose of various flare fittings and recognize when and where they are used.

Complete fitting assemblies using appropriate tools and procedures that meet specifications for installation.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

RESOURCES:

Related Information Plumbing 2, Slater.

Basic tools.
Tube bender.

PROCEDURE:

1. **Read the following:**

   There are two general types of flare fittings. One type of flare fitting uses a compression nut to attach a flared pipe as shown in Figure 1.

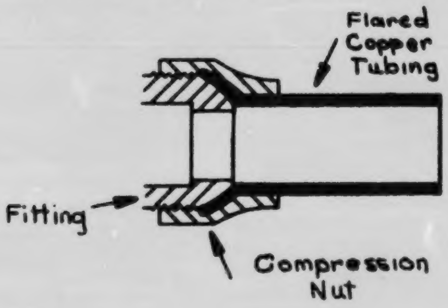
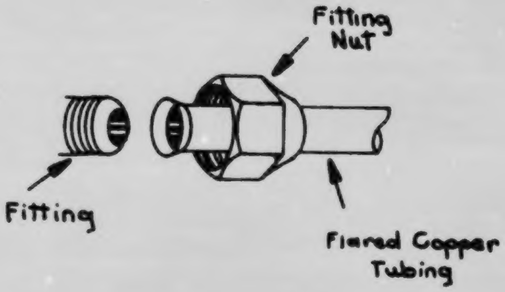


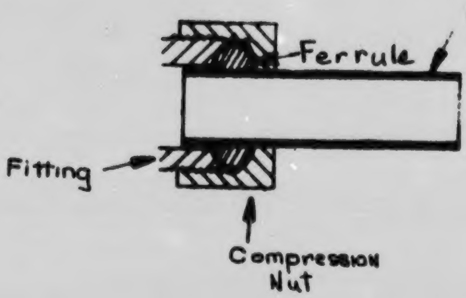
FIGURE 1:



Principal Author(s):
R. Arneson
T. Bundy
T. Frisbee

PROCEDURE: continued

The other type of flare fitting uses a compression nut to attach the pipe with a ferrule. This compression fitting attachment is shown in Figure 2.



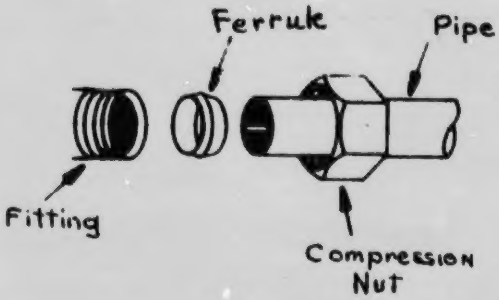


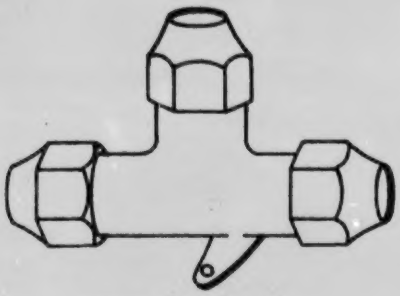
FIGURE 2:

The fittings using the ferrule type of tube attachment are called compression fittings. The fittings that use the flared tube are called flare fittings.

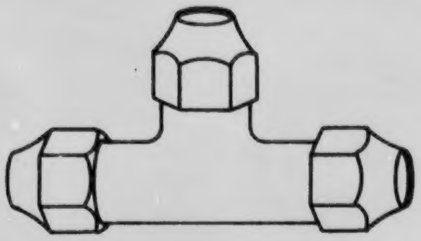
Flare fittings are measured and ordered in relation to the size tubing that they are used with. Flexible copper tubing is always ordered from its inside diameter I.D.. This is in contrast to refrigeration types of piping. They are ordered by their inside and outside diameter. Only a few fittings are needed for flexible tubing since it can be readily shaped without the use of special tools. Care must be taken when bending flexible tubing not to bend the tubing so much that it crimps. This will reduce the flow of liquid and/or cause a weakness in the plumbing system. The common fittings are 90 degree elbows, tees, couplings and adapters. The common type of fittings are shown in Figure 3, page 3.

Compression fittings are not used very often in the plumbing trade. They are used primarily to connect the water supplies on various fixtures to the water supply lines. Compression fittings require a connecting nut and a sleeve. The compression nut is placed on the supply line first. (See Figure 2.) The ferrule is then placed on the soft copper line. When the nut is tightened on the fitting, the ferrule is compressed between the nut and the fitting forming a water tight seal.

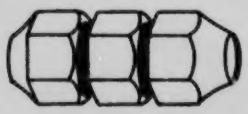
Compression fittings look like the flare fittings shown in Figure 3, page 3. The primary difference is the compression area where the tube and ferrule enter the fitting. Figure 2.should be compared with Figure 1 to see this difference. A comparison of an actual compression and flare fitting should further clarify the difference.



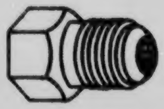
Drop Ear Tee



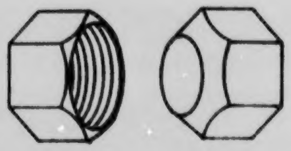
Tee



Couplings

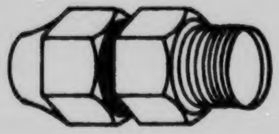


Plug

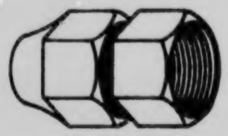


Inside Outside

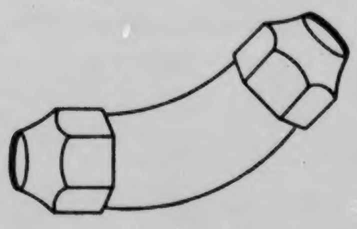
Cap



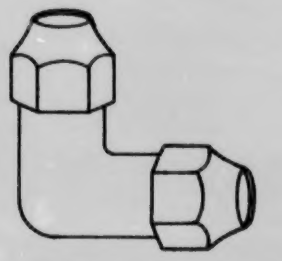
Male Adapter



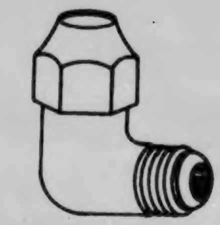
Female Adapter



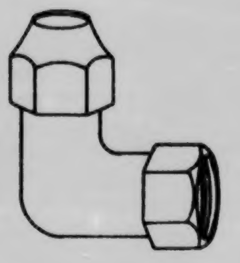
45° Elbow



90° Elbow



Male Elbow



Female Elbow

Figure 3

PROCEDURE: continued

2. Read about flared type of copper tube fittings on pages 7 and 8 in Related Information Plumbing 2 and do the following assignment:

   Answer questions 16 through 20 on pages 10 and 11.

   Check your answers with the answer key.

3. Obtain the box containing an assortment of flare and compression fittings.

4. Complete the attached form "Fittings Identification" as directed on the sheet.

5. Check answers with the answer key.

6. If the description and function statements are satisfactory, prepare the assembly as shown on the attached sketch "Flare/Compression Fitting Assembly."

   If the statements are unsatisfactory, proceed as the instructor directs.

7. Have the instructor evaluate the flare/compression fitting assembly.

8. If the assembly is satisfactory, take the LAP test. If the assembly is unsatisfactory, proceed as directed by the instructor.

9. Score and return the LAP test.

10. If the LAP test is satisfactory, begin the next assigned LAP.

    If the test is not satisfactory, proceed as the instructor suggests.

FITTINGS IDENTIFICATION

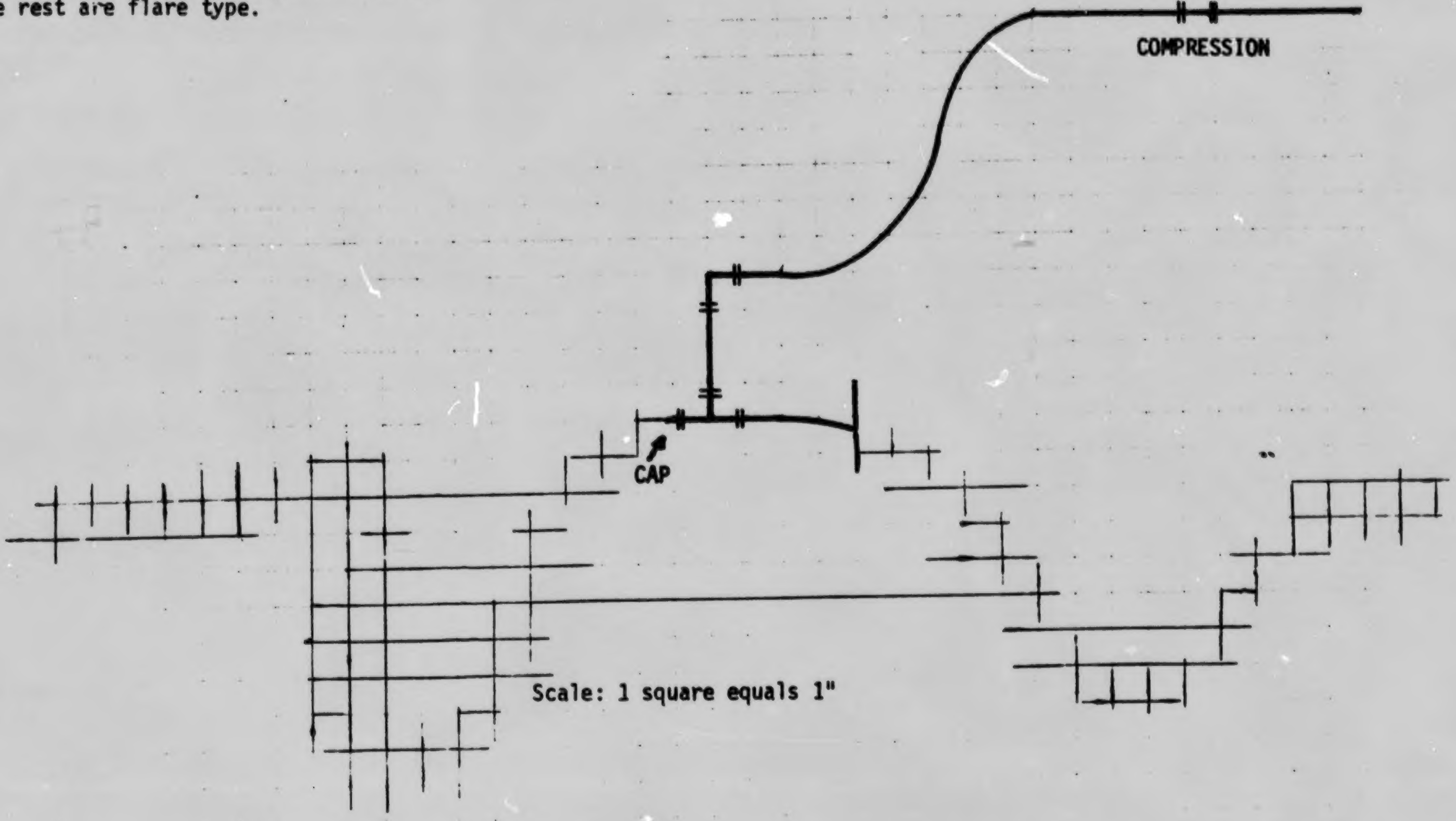
Directions: Select a fitting from the assortment. After the number below that matches the fitting number write the description and function.

Work Station Number____________________ Box Number__________________________

FITTING NUMBER	DESCRIPTION (Size, Weight, Type, Etc.)	FUNCTION (For What Used)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Flare/Compression Fitting Assembly

DIRECTIONS: One of the fittings shown is to be a compression type of fitting the rest are flare type.



Scale: 1 square equals 1"

File Code: 73.02.03.00.A2-1

Date Published: 7/15/75

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Experience Guide

UNIT: HOT WATER SUPPLY

RATIONALE:

Plumbers are required to install hot water supply systems. Hot water systems must be designed and installed to explicit specifications and codes if the customer is to be satisfied with the completed installation. This unit will develop your skills and knowledge so that you will be able to lay out, install, and service a hot water supply system.

PREREQUISITES:

Prerequisites are the same as those listed for the course. (See the "Supply Piping Systems" course LEG.)

OBJECTIVES:

Recognize the concepts and principles involving heat and its affect on water in plumbing systems.

Identify procedures for measuring, laying out, preparing and assembling flared pipe and fittings used in supply piping systems.

Identify the type and functions of copper flared pipe and fittings and compression fittings.

Identify the procedure for installing and servicing water heaters and hot water storage tanks.

Solve problems determining the quantity of heat.

List material requirements, measure, lay out, prepare and assemble copper pipe and fittings for supply piping systems according to given specifications following safe practices.

Install and service water heaters.

RESOURCES:

Printed Materials

Collection of manufacturer's specification sheets.
Montana State Plumbing Code.

Principal Author(s):

Arneson, Bundy, Frisbee

RESOURCES: (continued)

Printed Material:

Plumbers and Pipe Fitters Library: Drainage, Fittings, Fixtures, Volume 2. Jules Oravetz, Sr., Theodore Audel and Company, 1967.
Related Information Plumbing 1. Harry Slater, Delmar Publishers, 1958.
Related Information Plumbing 2. Harry Slater, Delmar Publishers, 1959.

Equipment

Bender, tube.
Brushes, fitting, cleaner (assorted).
Swaging tool.
Tools, basic (plumber): bit, drill (set) (1/16 to 1/4 inch)
box, tool
chalk line
cutter, tubing (1/8 to 5/8 inch)
cutter, tubing (imp)
flaring tool
hacksaw
hammer, claw (16 oz.)
plier, channel lock
rule, steel (12 ft.)
screwdriver (4 in one)
square, combination (12 inch)
wrench, Allen (set)
wrench, open-end, adjustable (6 and 8 inch)
wrench, open-end/box, combination (3/8 to 3/4 inch)
wrench, pipe (12 inch)
Torch and tank, Presto Lite or equivalent.
Threader/Reamer/Cutter, pipe, power combination.
Wrench, pipe (14, 18, 24 and 36 inch).

GENERAL INSTRUCTIONS:

This unit consists of eight Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

(1) Read the first assigned Learning Activity Package (LAP).
(2) Begin and complete the first assigned LAP.
(3) Take and score the LAP test.
(4) Turn in the LAP test answer sheet.
(5) Determine the reason for any missed items on the LAP test.
(6) Proceed to and complete the next assigned LAP in the unit.
(7) Complete all required LAPs for the unit by following steps 3 through 6.
(8) Take the unit tests as described in the Unit LEG "Evaluation Procedures".
(9) Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 Copper Pipe Flaring and Assembly
.02 Flare Fittings
.03 British Thermal Unit and Expansion of Water
.04 Convection, Conduction and Radiation
.05 Hot Water Heaters and Storage Tanks
.06 Thermostats and Pressure Relief Valves
.07 Water Heater Installation
.08 Water Heating Servicing

EVALUATION PROCEDURE:

When pretesting:

1. The student takes the unit multiple-choice pretest.
2. Successful completion is 4 out of 5 items for each LAP part of the pretest.
3. The student then takes a unit performance test if the unit pretest was successfully completed.
4. Satisfactory completion of the performance test is meeting the criteria listed on the performance test.

When post testing:

1. The student takes a multiple-choice unit post test and a unit performance test.
2. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

Go to the first assigned Learning Activity Package (LAP) listed on your Student Progress Record (SPR).

Student: ____________________ **File Code:** 73.02.03.00.A2-2

Date: ____________________ **Date Published:** 11/25/74

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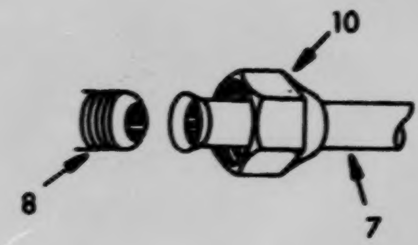
UNIT PRETEST: HOT WATER SUPPLY

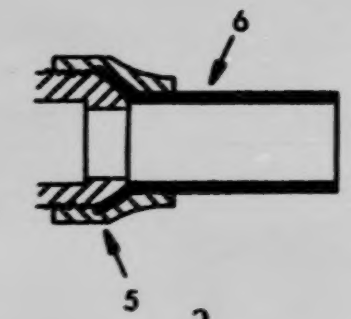
73.02.03.01

1. When a sleeve is used to join soft copper tubing, which of the following tools or supplies would not be needed?

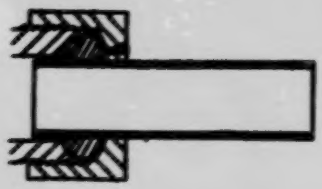
   a. tube cutter
   b. flaring tools
   c. compression nut
   d. fitting



1



2



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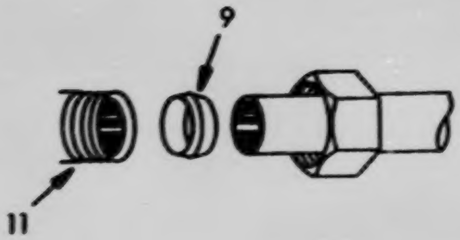

4

Diagram 27

2. Which number would identify a compression sleeve? (Use the diagrams on page 1.)

   a. 7
   b. 5
   c. 9
   d. 10

3. Which numbers would correspond to a description (pictorial) of compression joints? (Use the diagrams on page 1.)

   a. 3,4
   b. 1,2
   c. 1,4
   d. 2,3

4. Which of the following numbers would identify a cross section of a compression nut? (Use the diagrams on page 1.)

   a. 10
   b. 7
   c. 9
   d. 5

5. Which number would correspond to an isometric view of a compression fitting? (Use the diagrams on page 1.)

   a. 10
   b. 5
   c. 9
   d. 11

73.02.03.02

6. Which of the following numbers would correspond to an illustration of a male adapter? (Use the diagrams on page 3.)

   a. 4
   b. 8
   c. 11
   d. 7

7. Which of the following numbers would correspond to an illustration of a female adapter? (Use the diagrams on page 3.)

   a. 11
   b. 7
   c. 8
   d. 4

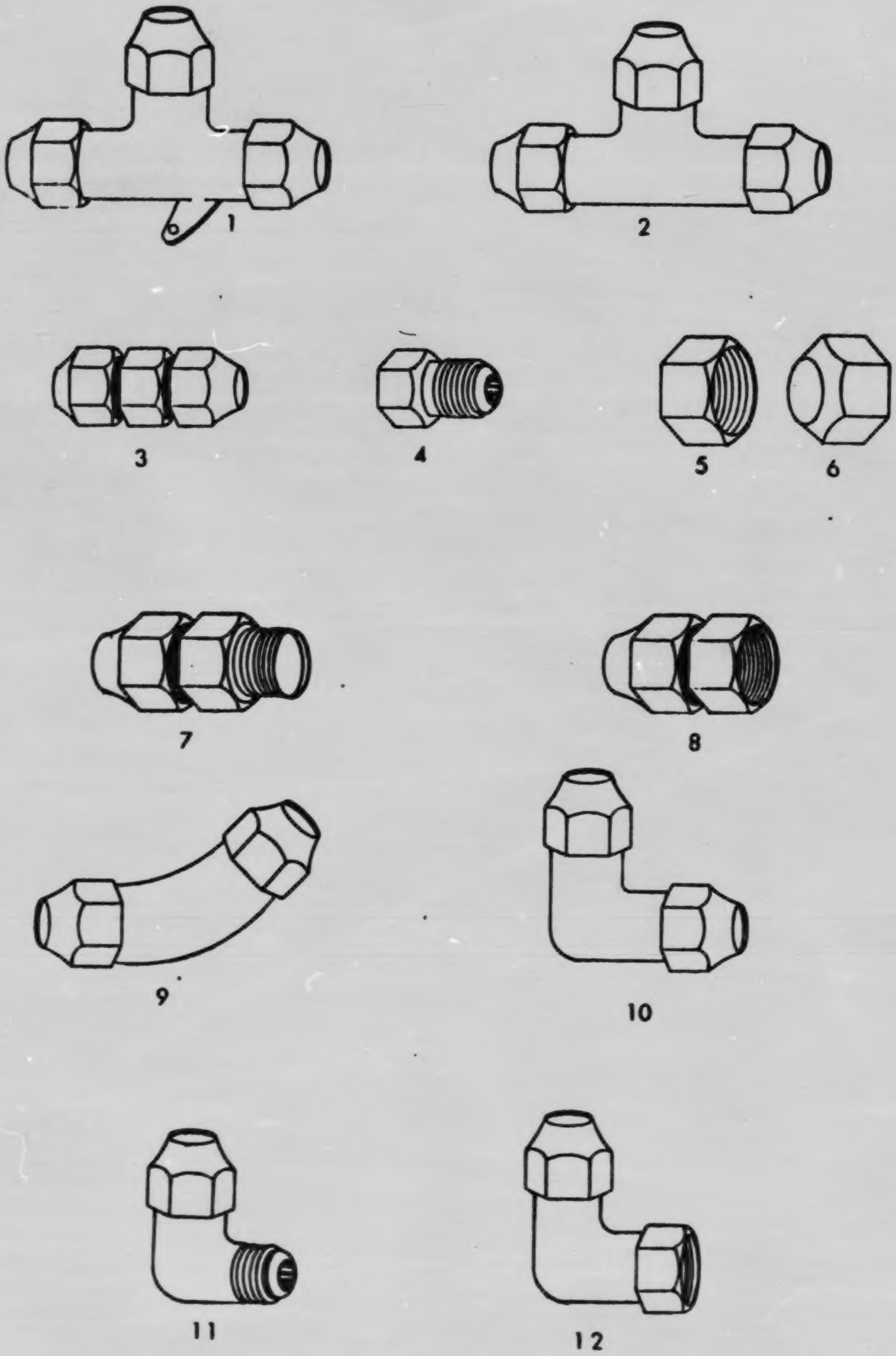
1
2
3
4
5
6
7
8
9
10
11
12

Diagram 28

73.02.03.02 (continued)

8. Which of the following numbers would correspond to an illustration of a coupling? (Use the diagrams on page 3.)

   a. 8
   b. 4
   c. 7
   d. 3

9. Which of the following numbers would correspond to an illustration of a 90 degree elbow? (Use the diagrams on page 3.)

   a. 9
   b. 10
   c. 12
   d. 11

10. Which of the following numbers would correspond to an illustration of a male elbow? (Use the diagrams on page 3.)

   a. 12
   b. 11
   c. 9
   d. 10

73.02.03.03

11. How many BTUs will raise 5 pounds of water from 40 degrees to 140 degrees?

   a. 2,500 BTUs.
   b. 100 BTUs.
   c. 50 BTUs.
   d. 500 BTUs.

12. Approximately how many BTUs will raise 25 gallons of water 35 degrees?

   a. 8,740 BTUs.
   b. 72.5 BTUs.
   c. 84.6 BTUs.
   d. 7,280 BTUs.

13. How many BTUs will raise 18 pounds of water from 23 degrees to 70 degrees?

   a. 65 BTUs.
   b. 47 BTUs.
   c. 18 BTUs.
   d. 846 BTUs.

73.02.03.03 (continued)

14. How many BTUs will raise 50 pounds of water from 32 degrees to 42 degrees?

a. 100 BTUs.
b. 500 BTUs.
c. 10 BTUs.
d. 1,000 BTUs.

15. How many pounds of pressure per square inch does ice apply to a pipe?

a. 8,720 lbs.
b. 212 lbs.
c. 22 lbs.
d. 33,000 lbs.

73.02.03.04

16. What causes draft in a chimney?

a. Air is always moving.
b. Air always goes up.
c. Air when heated falls.
d. Heated air rises.

17. What is convection sometimes called?

a. conduction
b. radiation
c. saturation
d. circulation

18. How should the pipe be pitched to a tank?

a. Level.
b. Up from the heater to the tank.
c. Down from the heater to the tank.
d. It makes no difference.

19. Which of the following would correspond to the following description: two parts hydrogen and one part oxygen?

a. Freon 22
b. Freon 12
c. water
d. ammonia

73.02.03.04 (continued)

20. Which of the following is the name of a method of heat transfer?

    a. radiation
    b. convection
    c. conduction
    d. saturation

73.02.03.05

21. Where should the furnace coil be placed in relation to the fire?

    a. along side the fire
    b. below
    c. above
    d. location is not important

22. Where is the coldest water found on a horizontal hot water tank?

    a. on the side
    b. near the top
    c. near the bottom
    d. near the middle

23. What is the location of the return tapping on a hot water tank?

    a. On the side 6 inches from the bottom.
    b. On the top 8 inches from the center.
    c. On the bottom 8 inches from the center.
    d. On the side 20 inches from the top.

24. What is the on-center spacing of the hot and cold water supplies on a hot water tank?

    a. 10 inch O.C.
    b. 6 inch O.C.
    c. 8 inch O.C.
    d. 4 inch O.C.

25. What is connected to the bottom tapping of a vertical hot water tank?

    a. stand and draw off cock
    b. hot water outlet
    c. water supply
    d. relief valve

73.02.03.06

26. What happens to a copper tube that is heated?

    a. different circumstances cause different effects
    b. becomes shorter
    c. remains the same
    d. becomes longer

27. To decrease the pressure on a spring type relief valve:

    a. move the lever clockwise.
    b. tighten the adjusting screw.
    c. loosen the adjusting screw.
    d. slide the sleeve up.

28. What pressure-range valve would you use for a street pressure of 75 pounds (maximum)?

    a. 95 pounds
    b. 75 pounds
    c. 60 pounds
    d. 50 pounds

29. After the plumber has adjusted a lever-type relief valve to stop readjustment, he should:

    a. remove the lever.
    b. install a padlock.
    c. turn the lock nut down.
    d. break the excess off the lever.

30. Which of the following valves would be installed to stop explosions?

    a. globe valves
    b. relief valve
    c. pressure regulator valve
    d. check valve

73.02.03.07

31. Which number would identify the cold water baffle on the illustration of the electric heater? (Use the diagram on page 8.)

    a. 1
    b. 10
    c. 9
    d. 3

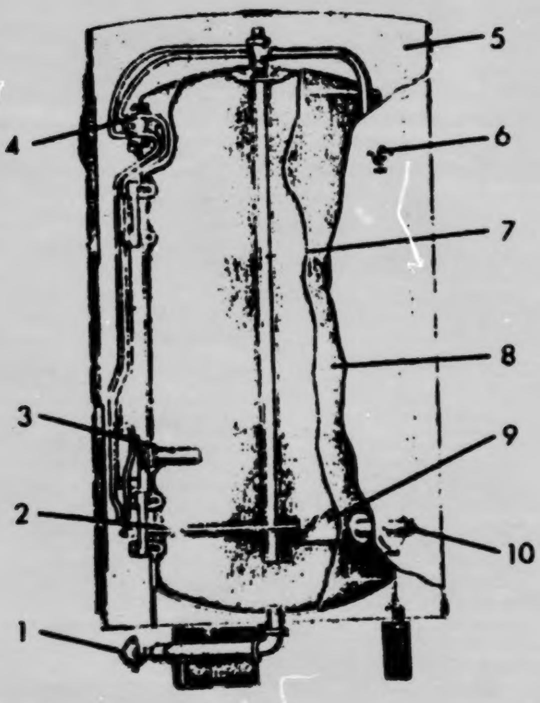
5
4
6
7
8
3
9
2
10
1

Diagram 30

73.02.03.07 (continued)

32. Which number would identify the drain faucet on the illustration of an electric water heater? (Use the diagram on page 8.)

a. 2
b. 1
c. 3
d. 10

33. Which number would identify the heating element in the electric water heater? (Use the diagram on page 8.)

a. 1
b. 2
c. 3
d. 4

34. Which number would identify the high temperature cut off limiting switch? (Use the diagram on page 8.)

a. 6
b. 5
c. 3
d. 4

35. On the illustration of an electric water heater with external elements, which numbers would identify the hot water outlet or supply? (Use the diagram on page 10.)

a. 2
b. 7
c. 6
d. 8

73.02.03.08

36. What should be put in the tube near the top on a hot water tank?

a. an anti-syphon hole
b. a relief valve
c. a pressure control valve
d. thermostat

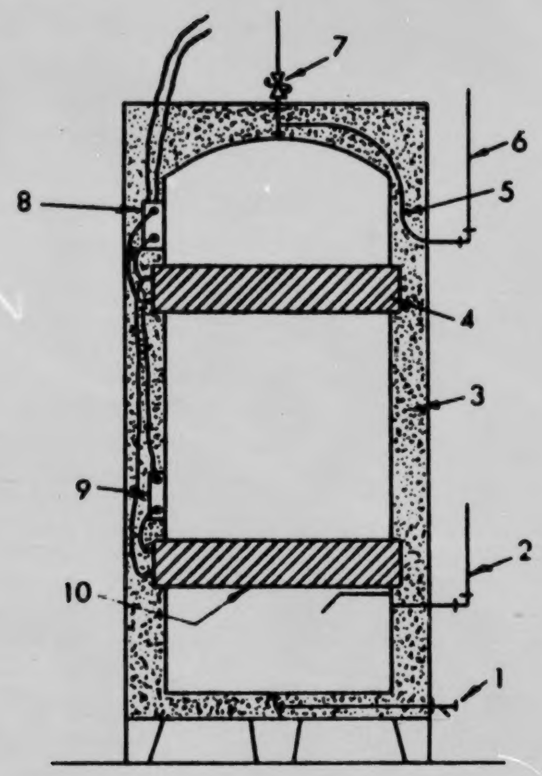
7
6
5
8
4
3
9
2
10
1

Diagram 31

73.02.03.08

37. Gas tank heaters are usually used as what type of heater?

    a. auxillary
    b. main heaters
    c. primary heaters
    d. principle heaters

38. Which tapping of a hot water tank should the top pipe from a gas water heater connect?

    a. discharge tapping
    b. flow tapping
    c. lower tapping
    d. drain cock tapping

39. The inlet flow tube should not be any closer than what distance from the bottom of a tank heater?

    a. 2 inches
    b. 6 inches
    c. 9 inches
    d. 12 inches

40. What is the purpose of the spring in a pressure valve?

    a. it opens the valve
    b. it opens and closes the valve
    c. it closes the valve
    d. it maintains balance in the valve

UNIT TEST ANSWER SHEET

(Unit Pretest Answer Key)

Occupational Area: ____________________
File Code: 73.02.03.00.A2-2
Name: ____________________

ANSWERS

73.02.03.01	1.	B	73.02.03.05	21.	C	41.	
	2.	C		22.	C	42.	
	3.	A		23.	A	43.	
	4.	C		24.	D	44.	
	5.	D		25.	A	45.	
.02.03.02	6.	D	73.02.03.06	26.	D	46.	
	7.	C		27.	C	47.	
	8.	D		28.	A	48.	
	9.	B		29.	D	49.	
	10.	B		30.	B	50.	
7.02.03.03	11.	D	73.02.03.07	31.	C	51.	
	12.	D		32.	B	52.	
	13.	D		33.	B	53.	
	14.	B		34.	D	54.	
	15.	D		35.	C	55.	
73.02.03.04	16.	D	73.02.03.08	36.	A	56.	
	17.	D		37.	A	57.	
	18.	B		38.	B	58.	
	19.	C		39.	D	59.	
	20.	C		40.	C	60.	

File Code: 73.02.03.01.A2-0

Date Published: 7/1[illegible]/75

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Copper Pipe Flaring and Assembly

OBJECTIVES:

Identify flare joints and their component parts.

Flare soft copper tubing using appropriate tools and procedures.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

The flare produced at the end of soft copper tubing meets given specifications.

RESOURCES:

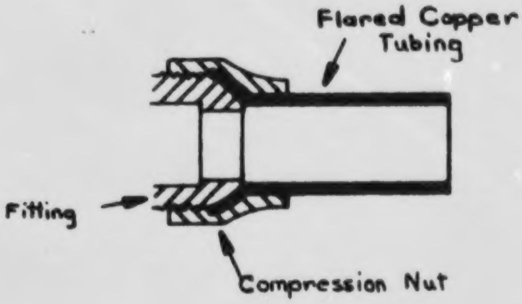
Basic tools.
Copper tubing and fitting.

PROCEDURE:

1. Read the following:

   Copper tubing may be joined by flaring the ends of the tubing and seating the flared end against the tapered surface of a fitting. The flared portion of the tubing is pressed and held firmly against the fitting by a threaded compression nut. See Figure 1.

FIGURE 1:



Principal Author(s):
R. Arneson
T. Bundy
T. Frisbee

PROCEDURE: continued

An air tight and water tight flared joint depends primarily on a quality flare being made on the tubing.

Preparing a quality flare on the end of a copper tube is the objective of this activity.

Flaring tools are made to produce the desired flare on a tube. The procedure for using the flaring tool follows:

(1) Loosen both wing nuts on the flaring bar.

(2) Insert squared and reamed tubing into the hole of proper size, with end of the tubing protruding above the top of the flaring bar by equal to the width of shoulder on the flaring bar.

(3) Tighten wing nuts.

(4) Place yoke over flaring bar so the flaring cone centers over the tubing.

(5) Screw down flaring cone until the copper tube is pressed against the shoulder of the flaring bar.

(6) Loosen and remove yoke.

(7) Loosen wing nuts on the flaring bar and remove the flared tubing.

2. Have an instructor complete the following tube flaring information:

Tube ________ ________ ________
Type ________ ________ ________
Size ________ ________ ________

3. Cut four inch pieces of tubing of the type and size shown above.

4. Flare an end of each piece of tubing as directed above.

5. Assemble the flared pieces of tubing on the given fittings.

6. Disassemble the fittings and flared pieces of tubing.

7. Have the instructor evaluate your flared pieces of tubing.

8. If the flaring is satisfactory, take the LAP test.

If the flaring is not satisfactory, proceed as the instructor suggests.

9. Score and return the LAP test.

10. If the LAP test is satisfactory, begin the next assigned LAP.

If the test is unsatisfactory, proceed as the instructor directs.

Student: ______________________________ **File Code:** 73.02.03.01.A2-2

Date: ______________________________ **Date Published:** 11/26/74

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LAP TEST: COPPER PIPE FLARING AND ASSEMBLY

1. When using a grabber flaring tool, approximately how far should the tubing extend up from the flaring block?

   a. 3/8 inch
   b. 1/8 inch
   c. 1/2 inch
   d. equal to the diameter of the pipe to be flared

2. When a sleeve is used to join soft copper tubing, which of the following tools or supplies would not be needed?

   a. tube cutter
   b. flaring tools
   c. compression nut
   d. fitting

3. If a flared joint is to be made on a system using soft copper tubing, which of the following tools or supplies would not be needed?

   a. sleeve
   b. tubing cutter
   c. flare nut
   d. fitting

4. Which number would identify a compression sleeve? (Use the diagrams on page 2.)

   a. 7
   b. 5
   c. 9
   d. 10

5. Which number would identify an isometric view of a flare fitting? (Use the diagrams on page 2.)

   a. 9
   b. 10
   c. 5
   d. 8

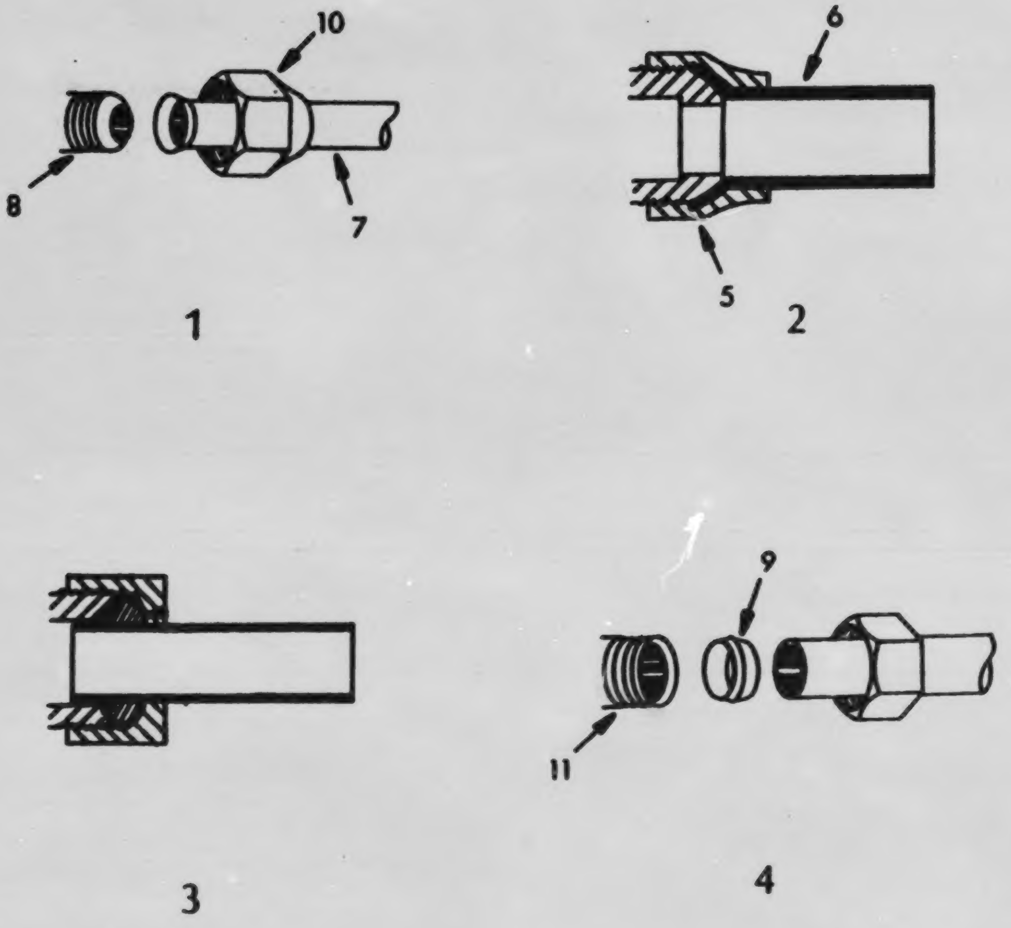
10
8
7
1
6
5
2
3
9
11
4

Diagram 27 -

6. Which numbers would correspond to a description (pictorial) of a compression joint? (Use the diagrams on page 2.)

   a. 3,4
   b. 1,2
   c. 1,4
   d. 2,3

7. Which numbers would correspond to a pictorial description of a flare joint? (Use the diagrams on page 2.)

   a. 2,3
   b. 3,4
   c. 1,4
   d. 1,2

8. Which of the following numbers would identify a cross section of a compression nut? (Use the diagrams on page 2.)

   a. 10
   b. 7
   c. 9
   d. 5

9. Which of the following numbers would identify an isometric view of a compression nut? (Use the diagrams on page 2.)

   a. 6
   b. 7
   c. 10
   d. 9

10. Which number would correspond to an isometric view of a compression fitting? (Use the diagrams on page 2.)

    a. 10
    b. 5
    c. 9
    d. 11

LAP TEST ANSWER KEY: COPPER PIPE FLARING AND ASSEMBLY

1. B
2. B
3. A
4. C
5. D
6. A
7. D
8. D
9. C
10. D

Student: ______________________ File Code: 73.02.03.02.A2-2

Date: ______________________ Date Published: 11/26/74

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LAP TEST: FLARE AND COMPRESSION FITTINGS

1. What is the name of the tool used to prepare soft copper tubing for a flared joint?

   a. paring tool
   b. flaring tool
   c. mitre tool
   d. mitre gauge

2. Which of the following is not a size in which wrought-type copper tube elbows are made? (Use the diagrams on page 2.)

   a. 5/8 inch
   b. 1/2 inch
   c. 1 inch
   d. 2 inches

3. Which of the following numbers would correspond to an illustration of a 45 degree ell? (Use the diagrams on page 2.)

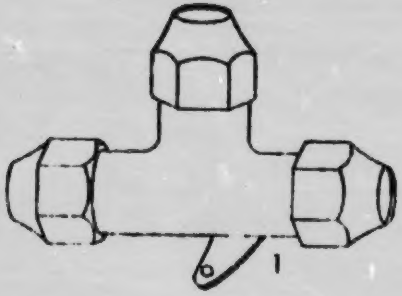
   a. 11
   b. 10
   c. 9
   d. 12

4. Which of the following numbers would correspond to a female elbow? (Use the diagrams on page 2.)

   a. 11
   b. 12
   c. 10
   d. 9

5. Which of the following numbers would correspond to an illustration of a male adapter? (Use the diagrams on page 2.)

   a. 4
   b. 8
   c. 11
   d. 7



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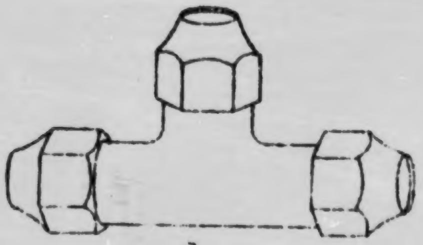

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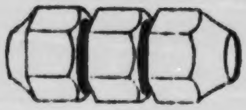

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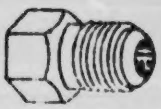

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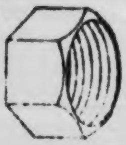

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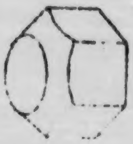

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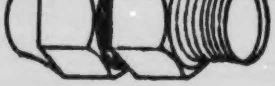

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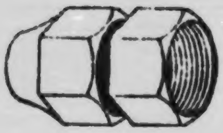

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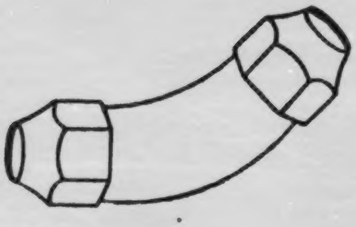

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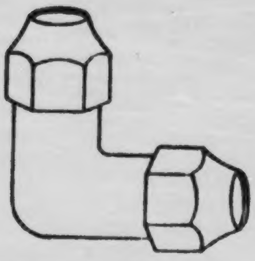

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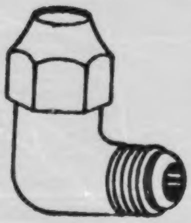

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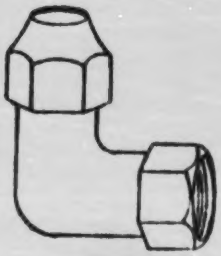

12

Diagram 28

6. Which of the following numbers would correspond to an illustration of a coupling? (Use the diagrams on page 2.)

   a. 8
   b. 4
   c. 7
   d. 3

7. Which of the following numbers would correspond to an illustration of a tee? (Use the diagrams on page 2.)

   a. 2
   b. 1
   c. 9
   d. 10

8. Which of the following numbers would correspond to an illustration of a plug? (Use the diagrams on page 2.)

   a. 5
   b. 4
   c. 6
   d. 8

9. Which of the following numbers would correspond to an illustration of a drop ear tee? (Use the diagrams on page 2.)

   a. 1
   b. 2
   c. 9
   d. 10

10. Which of the following numbers would correspond to an illustration of a 90 degree elbow? (Use the diagrams on page 2.)

    a. 9
    b. 10
    c. 12
    d. 11

LAP TEST ANSWER KEY: FLARE AND COMPRESSION FITTINGS

1. B
2. A
3. C
4. B
5. D
6. D
7. A
8. B
9. A
10. B

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Date Published: 7/15/75

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student:

Date:

PERFORMANCE ACTIVITY: British Thermal Unit and Expansion of Water

OBJECTIVES:

Define the British Thermal Unit (BTU) and solve problems that involve finding the quantity of heat in BTU's.

Recognize the effects of heat on water pressure.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

RESOURCES:

Related Information Plumbing 2, Slater.

PROCEDURE:

1. Read about the British Thermal Unit (BTU) on pages 140 and 141 in Related Information Plumbing 2. Focus your attention of what the BTU is and how it is used.
2. Answer the questions on pages 141 through 143 in the above resource. Check the answers with the answer key.
3. If all questions are answered correctly, take the LAP test.

   Any questions missed are to be reviewed by first using the resource and then checking with the instructor until the correct answer is understood.
4. Score and return the LAP test.
5. If the LAP test is satisfactory, begin the next assigned LAP.

   If the LAP test is not satisfactory, proceed as directed by the instructor.

Principal Author(s):

Arneson, Bundy, Frisbee

Student: ______________________ File Code: 73.02.03.03.A2-2

Date: ______________________ Date Published: 11/26/74

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LAP TEST: BRITISH THERMAL UNIT AND EXPANSION OF WATER

1. How many times its own volume will a cubic inch of water expand when heated to steam?

   a. 10 times
   b. 1,728 times
   c. 10,743 times
   d. 1,100 times

2. How much in gallons will the water in a thirty-gallon boiler expand when heated from [illegible] to 212 degrees?

   a. 5.5 gallons
   b. 1.15 gallons
   c. .5 gallons
   d. 7.2 gallons

3. How many BTUs will raise the water in a 5' x 22" boiler from 60 degrees to 140 degrees?

   a. 879,420 BTUs
   b. 564,320 BTUs
   c. 66,640 BTUs
   d. 79,320 BTUs

4. At what temperature does a cubic foot of water weigh the heaviest?

   a. 32 degrees
   b. 60 degrees
   c. 39.2 degrees
   d. 212 degrees

5. How many BTUs will raise 20 gallons of water to 120 degrees?

   a. 9,720 BTUs
   b. 20,780 BTUs
   c. 19,992 BTUs
   d. 99,740 BTUs

6. How many BTUs will raise 40 gallons of water from 40 degrees to the boiling point?

   a. 59,620 BTUs
   b. 7,840 BTUs
   c. 57,310 BTUs
   d. 62,430 BTUs

7. How many BTUs will raise 5 pounds of water from 40 degrees to 140 degrees?

   a. 2,500 BTUs
   b. 100 BTUs
   c. 50 BTUs
   d. 500 BTUs

8. How many BTUs will raise 18 pounds of water from 23 degrees to 70 degrees?

   a. 65 BTUs
   b. 47 BTUs
   c. 18 BTUs
   d. 846 BTUs

9. How many pounds of pressure per square inch does ice apply to a pipe?

   a. 8,720 lbs.
   b. 212 lbs.
   c. 22 lbs.
   d. 33,000 lbs.

10. When water is heated by a hot water tank and no water is drawn from the tank, where does the expanded water go?

    a. it expands the tank
    b. nowhere
    c. back into the main
    d. it expands the pipes

LAP TEST ANSWER KEY: BRITISH THERMAL UNIT AND EXPANSION OF WATER

1. B
2. B
3. C
4. C
5. C
6. C
7. D
8. D
9. D
10. C

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File Code: 73.02.03.04.A2-0

Date Published: 7/15/75

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Convection, Conduction and Radiation

OBJECTIVES:

Recognize the three principles of heat transfer (convection, conduction and radiation) as they apply to hot water supply systems.

EVALUATION PROCEDURE:

The successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

RESOURCES:

Related Information Plumbing 2, Slater.

PROCEDURE:

1. Using Related Information Plumbing 2, do the following assignments:
    a. Read about the principles of heat transfer on pages 144-146.
    b. Answer the questions and make requested sketches on pages 146-150.
    c. Check the answers with the answer key. Determine the reason for any differences in answers.
    d. Read about the principles of circulation on pages 155-157.
    e. Answer the questions and make sketches requested on pages 157-159.
    f. Check answers with the answer key. Determine the reasons for any differences in the answers.
2. Take the LAP test.
3. Score and return the LAP test.
4. If the LAP test is satisfactory, begin the next assigned LAP.

    If the LAP test is unsatisfactory, proceed as directed by the instructor.

Principal Author(s):

Arneson, Bundy, Frisbee

Student: ____________________ File Code: 73.02.03.04.A2-2

Date: ____________________ Date Published: 11/26/74

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LAP TEST: CONVECTION, CONDUCTION AND RADIATION 'ION

1. What is heat?
   a. a form of energy
   b. lack of cold
   c. a form of mechanical energy
   d. a form of light

2. Which of the following is a good insulator for heat?
   a. wood
   b. glass
   c. copper
   d. dead air space

3. What causes draft in a chimney?
   a. Air is always moving.
   b. Air always goes up.
   c. Air, when heated, falls.
   d. Heated air rises.

4. How should the pipe be pitched to a tank?
   a. level
   b. up from the heater to the tank
   c. down from the heater to the tank
   d. it makes no difference

5. Which of the following would correspond to the following description: 2 parts hydrogen and one part oxygen?
   a. Freon 22
   b. Freon 12
   c. water
   d. ammonia

6. What covering is used for a steam main?
   a. aluminum
   b. copper
   c. asbestos
   d. plastic tape

7. Steam lines are wrapped because of which of the following characteristics?

   a. saturation
   b. radiation
   c. conduction
   d. convection

8. Copper coils are used in hot water heaters because of which of the following?

   a. convection rate
   b. conduction rate
   c. radiation rate
   d. saturation rate

9. What direction do the molecules go when heat is added to an iron bar?

   a. hot to cold
   b. north to south
   c. south to north
   d. cold to hot

10. All matter is composed of:

   a. electrons.
   b. protons.
   c. neutrons.
   d. molecules.

LAP TEST ANSWER KEY: CONVECTION, CONDUCTION AND RADIATION

1. A
2. D
3. D
4. B
5. C
6. C
7. C
8. B
9. A
10. D

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File Code: 73.02.03.05.A2-0

Date Published: 7/15/75

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Hot Water Heaters and Storage Tanks

OBJECTIVES:

Identify the various types of water heaters and explain the operation of the heating element.

Identify the proper hook-ups to the various types of water storage tanks.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

RESOURCES:

Related Information Plumbing 1, Slater.

Related Information Plumbing 2, Slater.

PROCEDURE:

1. Using Related Information Plumbing 1, do the following assignments:
   a. Read pages 160 and 161.
   b. Answer the questions on page 162. Check the answers with the answer key. Determine the reason for any differences between the answer key and your answers.
   c. Read pages 163 and 164.
   d. Answer the questions on pages 164 and 165. Check the answers with the answer key. Determine the reason for any differences between the answer key and your answers.
   e. Read pages 166 and 167.
   f. Answer the questions on pages 167 and 168. Check the answers with the answer key. Determine the reason for any differences between the answer key and your answers.

Principal Author(s):

Arneson, Bundy, Frisbee

PROCEDURE: continued

2. Using Related Information Plumbing 2, do the following assignments:
   a. Read page 138.
   b. Answer the questions on page 139. Check the answers with the answer key. Determine the reason for any differences between the answer key and your answers.
   c. Read pages 166 and 167.
   d. Answer the questions on page 167. Check the answers with the answer key. Determine the reason for any differences between the answer key and your answers.
   e. Read pages 168 and 169.
   f. Answer the questions on page 169 and 170. Check the answers with the answer key. Determine the reason for any differences between the answer key and your answers.
   g. Read pages 171 and 172.
   h. Answer the questions on page 172 and 173. Check the answers with the answer key. Determine the reason for any differences between the answer key and your answers.
3. Take the LAP test.
4. Score and return the LAP test.
5. If the LAP test is satisfactory, begin the next assigned LAP.

   If the LAP test is not satisfactory, proceed as directed by the instructor.

Student: ____________________ File Code: 73.02.03.05.A2-2

Date: ____________________ Date Published: 11/26/74

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LAP TEST: HOT WATER HEATERS AND STORAGE TANKS

1. Where should the furnace coil be placed in relation to the fire?

   a. along side the fire
   b. below
   c. above
   d. location is not important

2. If the outlet of the furnace coil is lower than the end that is in the fire, what would result?

   a. water hammer
   b. explosion
   c. extreme temperature variation
   d. no problem would exist

3. Where is the coldest water found on a horizontal hot water tank?

   a. on the side
   b. near the top
   c. near the bottom
   d. near the middle

4. The low pipe from the tank connects to what topping of a horizontal tank?

   a. bottom right side
   b. center
   c. bottom left side
   d. top tapping

5. If you put a 4'8" tube in a hot water tank, what would happen?

   a. water would discolor
   b. water flow would burn out the elements
   c. there is nothing wrong
   d. the water temperature would be too high

6. What will happen to a water heater if a cold water tube is left out of the tank?

   a. water would not flow
   b. cold water would cool the hot water
   c. water temperature would rise
   d. friction flow would be extremely high

7. What is the on-center spacing of the hot and cold water supplies on a hot water tank?

   a. 10 inch O.C.
   b. 6 inch O.C.
   c. 8 inch O.C.
   d. 4 inch O.C.

8. What are the various supply openings in hot water tanks called?

   a. seals
   b. plugs
   c. vents
   d. tappings

9. Where is the hot water supply on a hot water tank?

   a. on the top of the tank
   b. 6 inches from the bottom of the tank
   c. 6 inches from the top of the tank
   d. at the exact middle of the tank

10. What is connected to the bottom tapping of a vertical hot water tank?

   a. stand and draw off cock
   b. hot water outlet
   c. water supply
   d. relief valve

LAP TEST ANSWER KEY: HOT WATER HEATERS AND STORAGE TANKS

1. C
2. A
3. C
4. D
5. A
6. B
7. D
8. D
9. A
10. A

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Date Published: 7/15/75

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Thermostats and Pressure Relief Valves

OBJECTIVES:

Identify and express the purposes of thermostats and pressure relief valves used with water heaters.

Adjust and replace water heater thermostats and replace water heater pressure relief valves using appropriate tools, equipment and procedures.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

Thermostat adjustments and replacements and pressure relief valve replacements for water heaters meet specifications.

RESOURCES:

Related Information Plumbing 2, Slater.

PROCEDURE:

1. Using Related Information Plumbing 2, do the following assignments:
    a. Read about pressure relief valves on pages 157-160.
    b. Answer the questions and prepare sketches requested on pages 160-162.
    c. Check answers with the answer key. Determine the reason for any differences between the answer key and your answers.

Principal Author(s):

Arneson, Bundy, Frisbee

2. **Remove and install a pressure relief valve. Read the following information and instructions before assembly.**

Watts pressure and temperature relief valve is a typical valve that is used on most water heater applications. When installing the Watts pressure and temperature relief valve with an extension thermostat, it must be installed with the temperature sensing element immersed in the water within the top six (6) inches of the water tank as shown in Figures 1 and 2.

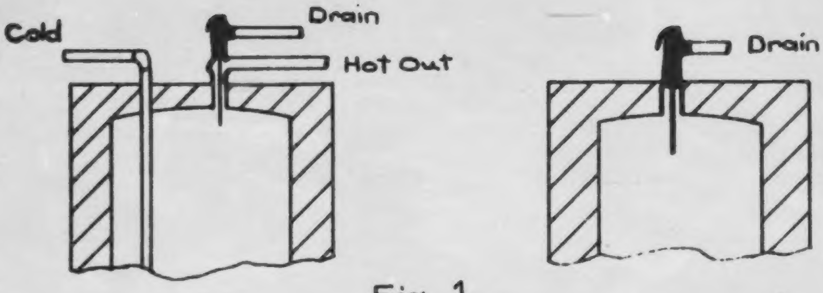

Fig. 1
Direct Top Tapping

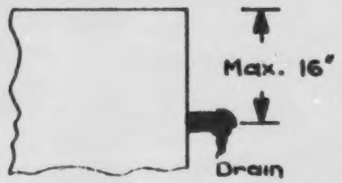

Fig. 2
Direct Side Tapping

The valve must be installed either in the hot water outlet service line or directly in a tank tapping as shown in Figure 1. To avoid water damage, drain pipe must be run to a safe place of disposal and must pich downward from the valve. Drain pipe must be the same size as the valve discharge connection throughout its entire length. No shutoff valve shall be installed between the relief valve and the tank in the drain line.

Key Point: Pressure and temperature relief settings are stamped on valve. Pressure setting should not be less than 25-30 lbs. above the maximum service main pressure and never above the allowable working pressure of the tank. Temperature relief is factory set and is not adjustable.

PROCEDURE: continued

3. Have the instructor evaluate the installation.

4. If the installation is satisfactory, continue to step 5.

   If the installation is unsatisfactory, proceed as directed by the instructor.

5. Using Related Information Plumbing 2, do the following assignments:

   a. Read about water heater thermostats on pages 154 and 155.

   b. Answer the questions on pages 155 and 156.

   c. Check the answers with the answer key. Determine the reason for any differences between your answers and the answer key.

6. Remove and replace thermostat(s) on a water heater. Adjust or calibrate, if possible, the thermostat to the temperature settings indicated by the instructor.

   NOTE: Thermostat is usually factory set.

   Replace the thermostat following wiring diagram and the installation instructions exactly. The instructor will use the installation instructions for evaluation and checkoff.

7. Have the instructor evaluate the installation.

8. If the installation is satisfactory, take the LAP test.

   If the installation is unsatisfactory, proceed as the instructor directs.

9. Score and return the LAP test.

10. If the LAP test is satisfactory, begin the next assigned LAP.

    If the LAP test is unsatisfactory, proceed as directed by the instructor.

Student: ____________ **File Code:** 73.02.03.06.A2-2

Date: ____________ **Date Published:** 11/26/74

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LAP TEST: THERMOSTATS AND PRESSURE RELIEF VALVES

1. Where should relief valves be installed?

   a. No closer than 10 feet.
   b. No closer than 5 feet.
   c. In or close to the tank.
   d. Location is not important.

2. Which type of thermostat has a separate pilot light?

   a. snap action
   b. throttling thermostat
   c. line thermostat
   d. low voltage thermostat

3. If the burner on a gas heater fails to light, what should you do?

   a. follow the same procedure again
   b. proceed with caution
   c. wait five minutes
   d. wait thirty minutes

4. To decrease the pressure on a spring type relief valve:

   a. move the lever clockwise.
   b. tighten the adjusting screw.
   c. loosen the adjusting screw.
   d. slide the sleeve up.

5. To increase the pressure of a spring type relief valve:

   a. slide the sleeve up.
   b. loosen the adjusting screw.
   c. tighten the adjusting screw.
   d. move the lever clockwise.

6. After the plumber has adjusted a lever-type relief valve to stop readjustment, he should:

   a. remove the lever.
   b. install a padlock.
   c. turn the lock nut down.
   d. break the excess off the lever.

7. Where should the discharge of a relief valve be piped?

   a. to a nearby fixture (sink)
   b. into the supply system
   c. to a floor drain
   d. to a convenient water closet

8. Which of the following valves would be installed to stop explosions?

   a. globe valves
   b. relief valve
   c. pressure regulator valve
   d. check valve

9. Which of the following would be a correctly ordered lever and weight type relief valve?

   a. 1/2 inch brass lever and weight relief valve for 75 lbs.
   b. 1/2 inch iron lever and weight relief valve for 75 lbs.
   c. 2-1/2 inch brass lever and weight relief valve for 150 lbs.
   d. 3 inch brass lever and weight relief valve for 175 lbs.

10. What type of thermostat uses a by-pass for its supply?

   a. low voltage thermostat
   b. snap action
   c. line thermostat
   d. throttling type

LAP TEST ANSWER KEY: THERMOSTATS AND PRESSURE RELIEF VALVES

1. C
2. A
3. C
4. C
5. C
6. D
7. C
8. B
9. A
10. D

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Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ________________

Date: ________________

PERFORMANCE ACTIVITY: Water Heater Installation

OBJECTIVES:

Connect various types of water heaters according to manufacturer's specifications.

The connection is made using appropriate tools and procedures.

Identify the various parts of gas and electric water heaters.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

Water heater installation meets the specifications of the manufacturer.

RESOURCES:

Manufacturer's Specification Sheets:

"Gas Water Heater Installing and Operating Instructions"
"Electric Water Heater Installing and Operating Instructions"
"Instructions for Installation and Operation: Rheem Model G661-W Glass Lined Electric Water Heater"

Related Information Plumbing 2, Slater.

Hand tools.
Pipe cutter/threader/reamer.
Pipe and fittings.
Pipe wrench.
Torch.

PROCEDURE:

1. Using Related Information Plumbing 2, do the following assignments:
    a. Read about gas water heaters on pages 151-152.
    b. Answer the questions on pages 152 and 153. Check answers with the answer key.

Principal Author(s):

Arneson, Bundy, Frisbee

PROCEDURE: continued

2. Install a gas water heater as directed on the manufacturer's specification sheet entitled "Gas Water Heater Installing and Operating Instructions."

3. Have the instructor evaluate your installation.

4. If the installation is satisfactory, begin step 5.

   If the installation is not satifactory, proceed as directed by the instructor.

5. Using Related Information Plumbing 2, do the following assignments:

   a. Read about electric water heaters on pages 163 and 164.

   b. Answer the questions on pages 164 and 165.

   c. Check the answers with the answer key. If there is a difference in answers, determine the reason for the difference.

6. Install an electric water heater as directed on the manufacturer's specification sheets entitled:

   "Electric Water Heater Installing and Operating Instructions"

   "Instructions for Installation and Operation: Rheem Model G661-W Glass Lined Electric Water Heater"

7. Have the instructor evaluate the installation.

8. If the evaluation is satisfactory, take the LAP test.

   If the installation is unsatisfactory, proceed as the instructor suggests.

9. Score and return the LAP test.

10. If the LAP test is satisfactory, begin the next assigned LAP.

    If the test is unsatisfactory, proceed as directed by the instructor.

Student: ______________________________ File Code: 73.02.03.07.A2-2

Date: ______________________________ Date Published: 11/26/74

LAP TEST: WATER HEAT INSTALLATION

1. What part of an automatic storage gas water heater receives direct heat?

   a. heat retarder
   b. flue
   c. air shutter
   d. preheater

2. From what part of the tank is the hot water supply taken?

   a. middle
   b. bottom
   c. top
   d. various locations

3. On the illustration of the gas hot water heater, which number would identify the air shutter? (Use the diagram on page 2.)

   a. 14
   b. 13
   c. 4
   d. 6

4. On the illustration of the electric water heater, which number would identify the magnesium anode? (Use the diagram on page 3.)

   a. 8
   b. 7
   c. 5
   d. 6

5. Which number would identify the cold water baffle on the illustration of the electric water heater? (Use the diagram on page 3.)

   a. 1
   b. 10
   c. 9
   d. 3

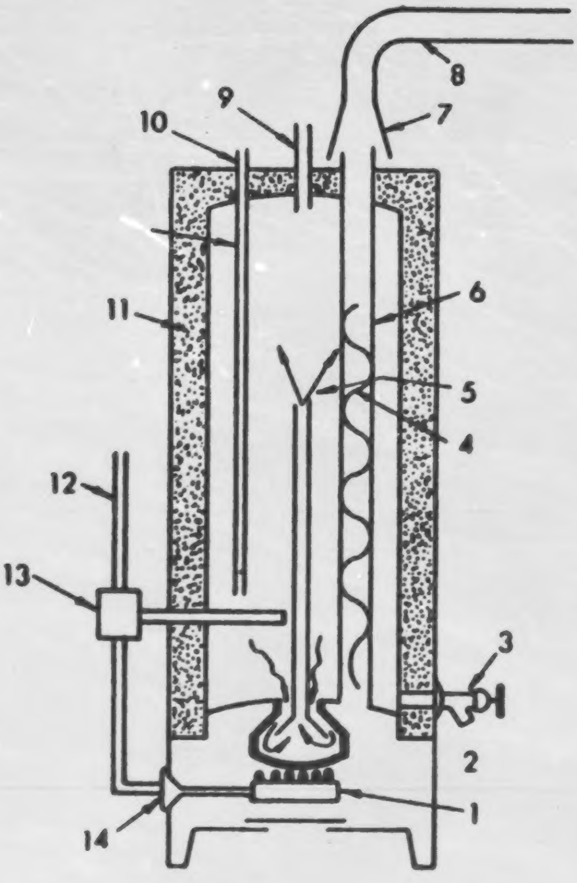
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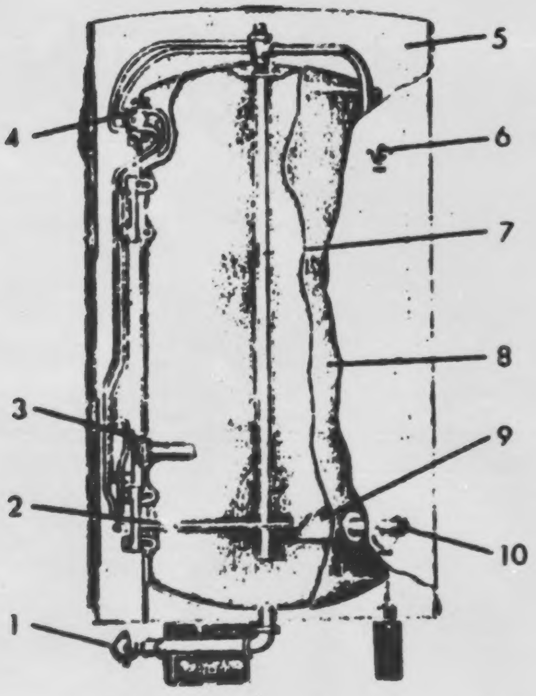
Diagram 29 Automatic Gas Water Heater



5
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1

Diagram 30

6. Which number would identify the heating element in the electric water heater? (Use the diagram on page 3.)

   a. 1
   b. 2
   c. 3
   d. 4

7. On the illustration of an electric water heater with external elements, which number would identify the hot water outlet or supply? (Use the diagram on page 5.)

   a. 2
   b. 7
   c. 6
   d. 8

8. Which number would identify the relief valve on the illustration of an electric water heater with external elements? (Use the diagram on page 5.)

   a. 1
   b. 5
   c. 7
   d. 8

9. On the illustration of an electric hot water heater with external elements, which number would identify the high temperature switch? (Use the diagram on page 5.)

   a. 5
   b. 9
   c. 7
   d. 8

10. On the illustration of an electric hot water heater with external elements, which number would identify the cold water supply? (Use the diagram on page 5.)

   a. 2
   b. 1
   c. 6
   d. 7

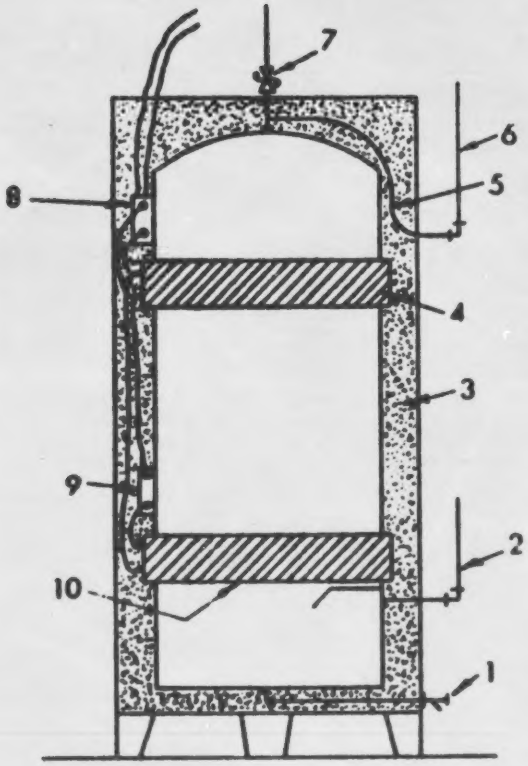
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Diagram 31

LAP TEST ANSWER KEY: WATER HEAT INSTALLATION

1. D
2. C
3. A
4. B
5. C
6. B
7. C
8. C
9. D
10. A

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File Code: 73.02.03.08.A2-0

Date Published: 7/15/75

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Water Heater Servicing

OBJECTIVES:

Perform routine maintenance and repair services on water heaters using appropriate tools, equipment and procedures. This includes adjusting, repair and replacing of control valves; adjustment and replacement of temperature controls; cleaning and adjusting burners; and replacement of heating elements that meet specifications of the manufacturer.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

Maintenance and service tasks performed follow desired procedures and result in equipment functioning according to the manufacturer's specifications.

RESOURCES:

Manufacturer's Specification Sheets:

"Gas Water Heater Installing and Operating Instructions"
"Electric Water Heater Installing and Operating Instructions"
"Instructions for Installation and Operation: Rheem Model G661-W Glass Lined Electric Water Heater"

Related Information Plumbing 1, Slater.

Related Information Plumbing 2, Slater.

Basic tools.
Pipe wrench.

Principal Author(s):

T. Bundy, R. Arneson, T. Frisbee

PROCEDURE:

1. Read the following:

   Maintenance and reservicing of water heating devices will involve new and old systems and equipment. In this activity the student will first study about water heating devices. Next, the student will study about pressure valves and bypasses. Practice is provided for gas and electric water heater maintenance and service.

2. Using Related Information Plumbing 1, do the following assignments:

   a. Read about tank heaters on pages 169-171.

   b. Answer the questions and make requested sketches on pages 171 and 172.

   c. Check the answers with the answer key. Determine the reason for any differences between your answers and the answer key.

   d. Read about gas tank heaters on pages 173 and 174.

   e. Answer the questions and make requested sketches on pages 175 and 176.

   f. Check the answers with the answer key. Determine the reason for any differences between your answers and the answer key.

   g. Read about bunsen burners on pages 177 and 178.

   h. Answer the questions on pages 178 and 179.

   i. Check the answers with the answer key. Determine the reason for any differences between your answers and the answer key.

3. Using Related Information Plumbing 2, do the following assignments:

   a. Read about pressure reducing valves and valve bypasses on pages 67 and 68.

   b. Answer the questions on pages 69 and 70.

   c. Check the answers with the answer key. Determine the reason for any differences between your answers and the answer key.

4. Obtain the sheet entitled "Gas Water Heater Installing and Operating Instructions."

   Perform the maintenance and service operations for the gas water heater as described on the sheet.

5. Have the instructor evaluate maintenance performed.

6. If the maintenance is satisfactory, begin step 7.

   If the maintenance is unsatisfactory, proceed as directed by the instructor.

PROCEDURE: continued

7. Obtain the sheets entitled:

    "Electric Water Heater Installing and Operating Instructions"

    "Instructions for Installation and Operation: Rheem Model G661-W Glass Lined Electric Water Heater"

    Perform the maintenance and servicing operations for the electric water heater that are described.

8. Have the instructor evaluate the maintenance performed.

9. If the maintenance is satisfactory, take the LAP test.

    If the maintenance is unsatisfactory, proceed as directed by the instructor.

10. Score and return the LAP test.

11. If the LAP test is satisfactory, begin the next assigned LAP.

    If the test is unsatisfactory, proceed as the instructor directs.

Student: ____________________ File Code: 73.02.03.08.A2-2

Date: ____________________ Date Published: 11/26/74

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LAP TEST: WATER HEATER SERVICING

1. Which of the following would be installed to protect a pressure valve?

   a. strainer
   b. gate valve
   c. drain
   d. globe valve

2. How would you correct a yellow flame in a Bunsen burner?

   a. more gas, less air or both
   b. less gas, more air or both
   c. less gas, less air or both
   d. less air

3. What is the approximate temperature of a properly functioning Bunsen burner?

   a. 450 degrees
   b. 2,250 degrees
   c. 4,850 degrees
   d. 12,000 degrees

4. Through which of the following does the Bunsen burner get it's primary air supply?

   a. air shutter
   b. nozzle
   c. regulator
   d. air valve

5. For what purpose is the extra side tapping in a hot water tank?

   a. to connect extra tank
   b. to allow vertical or horizontal installation
   c. to connect drain cock
   d. to connect addition flow pipe

6. What should be put in the tube near the top on a hot water tank?

   a. an anti-syphon hole
   b. a relief valve
   c. a pressure control valve
   d. a thermostat

7. Gas tank heaters are usually used as what type of heater?

   a. auxillary
   b. main heaters
   c. primary heaters
   d. principle heaters

8. To which tapping of a hot water tank should the top pipe from a gas water heater connect?

   a. discharge tapping
   b. flow tapping
   c. lower tapping
   d. drain cock tapping

9. The inlet flow tube should not be any closer than what distance from the bottom of a tank heater?

   a. 2 inches
   b. 6 inches
   c. 9 inches
   d. 12 inches

10. Why does the hot water travel out the top pipe on a tank heater?

    a. hot water is lighter than cold
    b. hot water is heavier than cold
    c. cold water is lighter than hot water
    d. hot water does not travel unless under live pressure

LAP TEST ANSWER KEY: WATER HEATER SERVICING

1. A
2. B
3. B
4. A
5. B
6. A
7. A
8. B
9. D
10. A

Student: ____________________ **File Code:** 73.02.03.00.B2-2

Date: ____________________ **Date Published:** 11/25/74

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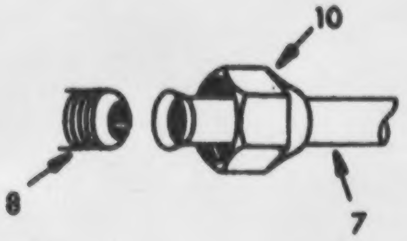
UNIT POST TEST: HOT WATER SUPPLY

73.02.03.01

1. If a flared joint is to be made on a system using soft copper tubing, which of the following tools or supplies would not be needed?

   a. sleeve
   b. tubing cutter
   c. flare nut
   d. fitting



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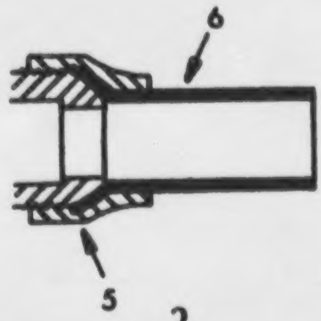

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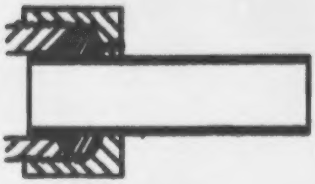

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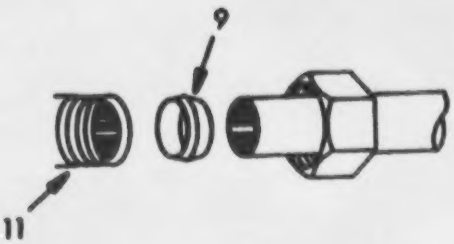

4

Diagram 27

73.02.03.01 (continued)

2. Which number would identify an isometric view of a flare fitting? (Use the diagrams on page 1.)

   a. 9
   b. 10
   c. 5
   d. 8

3. Which numbers would correspond to a description (pictorial) of a compression joint? (Use the diagrams on page 1.)

   a. 3,4
   b. 1,2
   c. 1,4
   d. 2,3

4. Which numbers would correspond to a pictorial description of a flare joint? (Use the diagrams on page 1.)

   a. 2,3
   b. 3,4
   c. 1,4
   d. 1,2

5. Which of the following numbers would identify an isometric view of a compression nut? (Use the diagrams on page 1.)

   a. 6
   b. 7
   c. 10
   d. 9

73.02.03.02

6. Which of the following numbers would correspond to an illustration of a female adapter? (Use the diagrams on page 3.)

   a. 11
   b. 7
   c. 8
   d. 4

7. Which of the following numbers would correspond to an illustration of an outside cap? (Use the diagrams on page 3.)

   a. 12
   b. 5
   c. 6
   d. 8

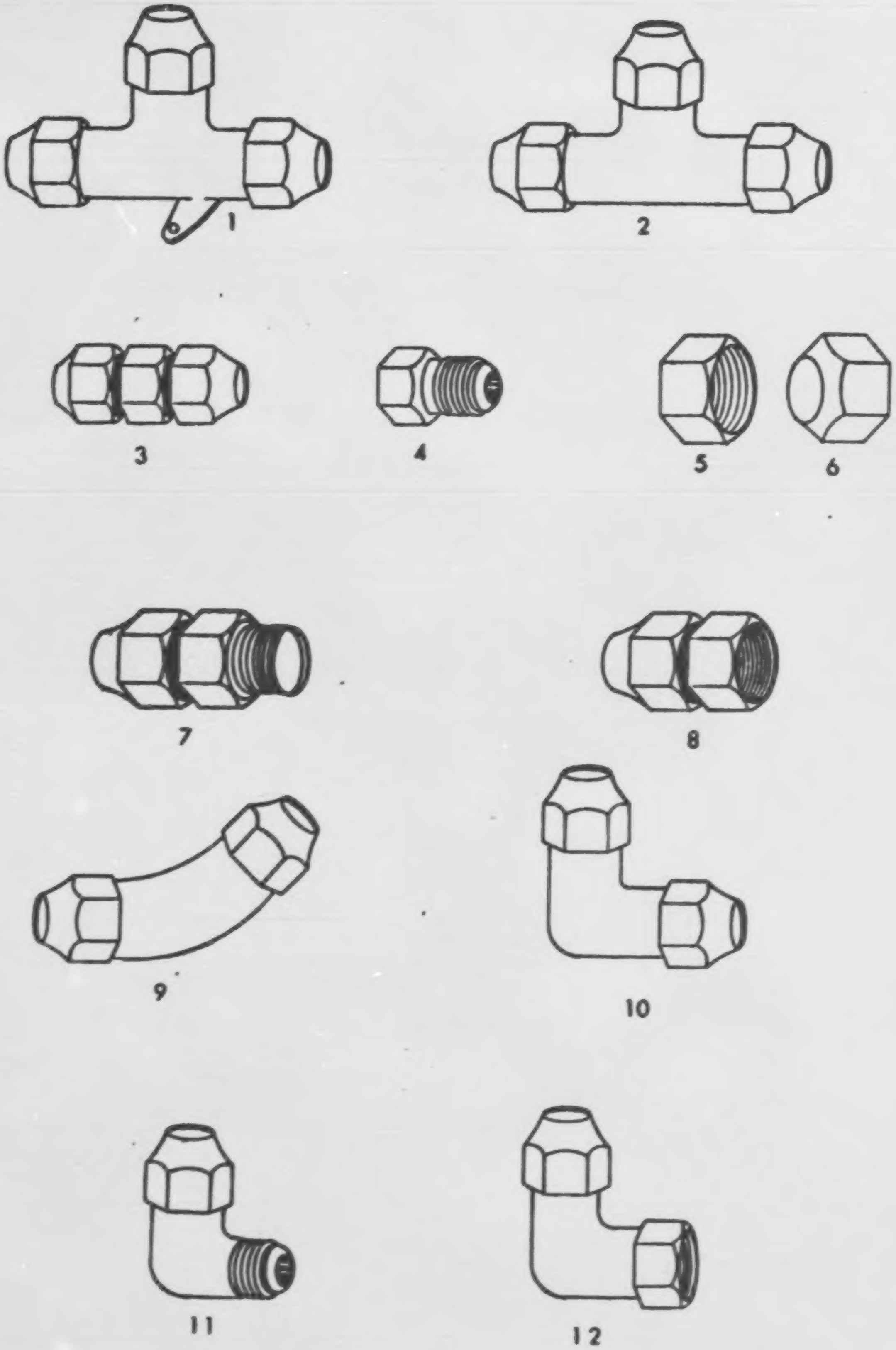
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Diagram 28

73.02.03.02 (continued)

8. Which of the following numbers would correspond to an inside cap illustration? (Use the diagrams on page 3.)

   a. 4
   b. 6
   c. 7
   d. 5

9. Which of the following numbers would correspond to an illustration of a 90 degree elbow? (Use the diagrams on page 3.)

   a. 9
   b. 10
   c. 12
   d. 11

10. Which of the following numbers would correspond to an illustration of a male elbow? (Use the diagrams on page 3.)

   a. 12
   b. 11
   c. 9
   d. 10

73.02.03.03

11. How many BTUs will raise the water in a 5' x 22" boiler from 60 degrees to 140 degrees?

   a. 879,420 BTUs.
   b. 564,320 BTUs.
   c. 66,640 BTUs.
   d. 79,320 BTUs.

12. How many BTUs will raise 5 pounds of water from 40 degrees to 140 degrees?

   a. 1,500 BTUs.
   b. 100 BTUs.
   c. 50 BTUs.
   d. 500 BTUs.

73.02.03.03 (continued)

13. Approximately how many BTUs will raise 25 gallons of water 35 degrees?

   a. 8,740 BTUs.
   b. 72.5 BTUs.
   c. 84.6 BTUs.
   d. 7,280 BTUs.

14. How many BTUs will raise 50 pounds of water from 32 degrees to 42 degrees?

   a. 100 BTUs.
   b. 500 BTUs.
   c. 10 BTUs.
   d. 1,000 BTUs.

15. When water is heated by a hot water tank and no water is drawn from the tank, where does the expanded water go?

   a. it expands the tank
   b. nowhere
   c. back into the main
   d. it expands the pipes

73.02.03.04

16. What is convection sometimes called?

   a. conduction
   b. radiation
   c. saturation
   d. circulation

17. What happens to water or air if it is heated?

   a. gets lighter and rises
   b. gets heavier and falls
   c. remains the same
   d. no pattern can be determined

18. How is the heat within a radiator transmitted to a room?

   a. by convection and radiation
   b. by convection
   c. by convection and conduction
   d. by conduction and radiation

73.02.03.04 (continued)

19. Which of the following is the name of a method of heat transfer?

    a. radiation
    b. convection
    c. conduction
    d. saturation

20. What effect does heat added to a bar of iron have on the molecules?

    a. has no effect on molecules
    b. decreases vibration of molecules
    c. stabilizes the molecules
    d. increases vibration of molecules

73.02.03.05

21. How far from the top should the hole in a boiler tube be positioned (maximum)?

    a. 18 inches
    b. 6 inches
    c. 1 foot
    d. 2 inches

22. A horizontal tank that is 18" x 60" would have what capacity?

    a. 25 gallons
    b. 30 gallons
    c. 100 gallons
    d. 60 gallons

23. If a 4'8" tube is placed in the hot water pipe, what would happen?

    a. no hot water could be obtained
    b. nothing, that is what should be done
    c. water would become riled up
    d. water temperature would be constant

24. What is the location of the return tapping on a hot water tank?

    a. on the side 6 inches from the bottom
    b. on the top 8 inches from the center
    c. on the bottom 8 inches from the center
    d. on the side 20 inches from the top

73.02.03.05 (continued)

25. What is the location of the flow tappings on a hot water tank?

a. on the side 6 inches from the top
b. on the side 8 inches from the center
c. on the bottom 4 inches from the center
d. on the side 10 inches from the bottom

73.02.03.06

26. On a system having 60 pounds of pressure and a hot water tank guaranteed at 150 lbs., at what pressure would you set the relief valve?

a. 75 lbs.
b. 60 lbs.
c. 150 lbs.
d. 125 lbs.

27. Where is the thermostat on a gas water heater located?

a. near the top
b. in the side near the bottom
c. near the middle
d. at the hot water supply tap

28. What happens to a copper tube that is heated?

a. different circumstances cause different effects
b. becomes shorter
c. nothing
d. becomes longer

29. What pressure-range valve would you use for a street pressure of 75 pounds (maximum)?

a. 95 pounds
b. 75 pounds
c. 60 pounds
d. 50 pounds

30. At what discharge pressure would you set a relief valve where the existing pressure is 40 pounds?

a. 20 pounds
b. 60 pounds
c. 80 pounds
d. 50 pounds

73.02.03.07

31. If the water is hot and the burner is off, what would start the burner?

    a. increase in water pressure
    b. increase in water temperature
    c. additional cold water
    d. increase in gas flow

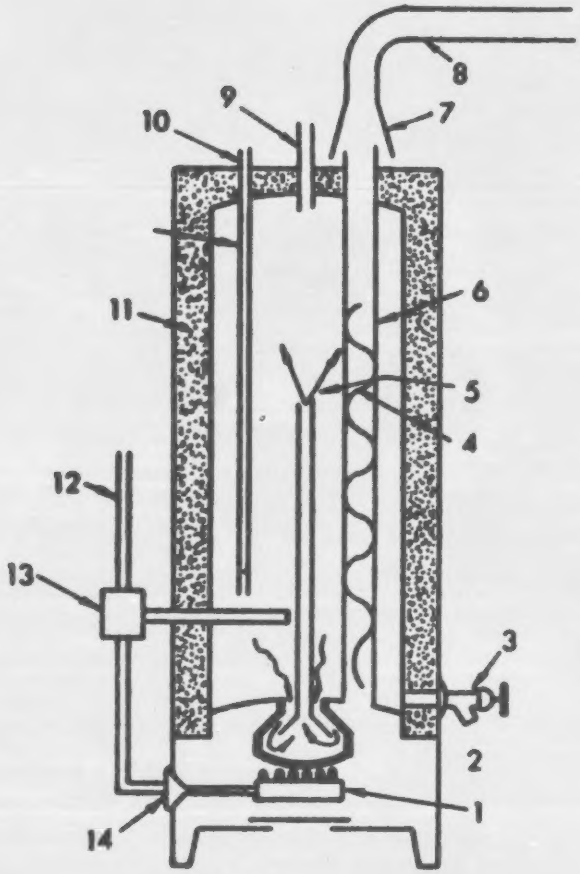

Diagram 29 Automatic Gas Water Heater

73.02.03.07

32. On the illustration of the gas water heater which number would correspond to the hot water supply? (Use the diagram on page 8.)

a. 12
b. 10
c. 9
d. 8

33. Which number would identify the thermostat on the illustration of the gas water heater? (Use the diagram on page 8.)

a. 1
b. 14
c. 4
d. 13

34. Which number would identify the drain faucet on the illustration of an electric water heater? (Use the diagram on page 10.)

a. 2
b. 1
c. 3
d. 10

35. What number would identify the high temperature cut off limiting switch? (Use the diagram on page 10.)

a. 6
b. 5
c. 3
d. 4

73.02.03.08

36. Where would you install a safety valve on a hot water heating unit?

a. In a position that has neutral pressure from both sides.
b. On the high pressure side of a water heating unit.
c. Either the high or low side.
d. On the low pressure side of a water heating unit.

37. What is the purpose of the jet action in a Bunsen burner?

a. draws in air
b. draws in water
c. pressurizes the water
d. pressurizes the gas flow

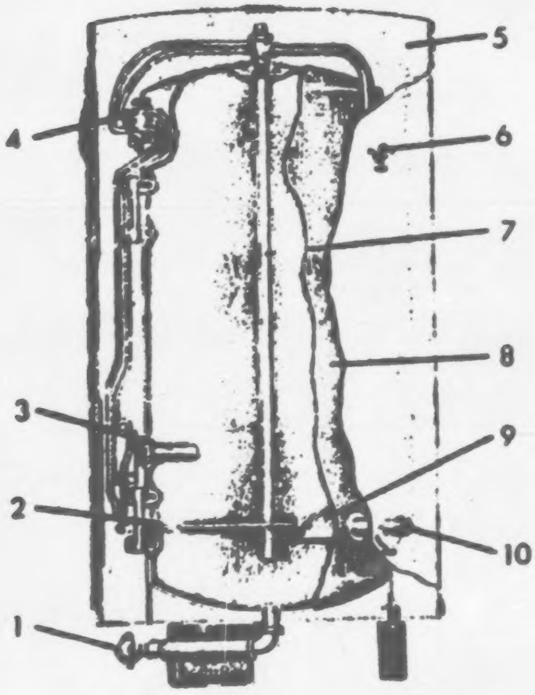
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Diagram 30

73.02.03.08 (continued)

38. Which of the following would be used to clean and empty a tank heater?

   a. draw off cock
   b. flow pipe
   c. relief valve
   d. hot water supply

39. What are the disadvantages of a long draw-off pipe that has many fittings, from a hot water tank?

   a. BTU loss
   b. hot water will not flow
   c. heat loss
   d. friction loss

40. What is the purpose of the spring in a pressure valve?

   a. it opens the valve
   b. it opens and closes the valve
   c. it closes the valve
   d. it maintains balance in the valve

UNIT TEST ANSWER SHEET
(Unit Post Test Answer Key)

Occupational Area: ______________________
File Code: 73.02.03.00.B2-2
Name: ______________________

ANSWERS

.02.03.01	1.	A ____	73.02.03.05	21.	D ____		41.	____
	2.	D ____		22.	D ____		42.	____
	3.	A ____		23.	A ____		43.	____
	4.	D ____		24.	A ____		44.	____
	5.	C ____		25.	A ____		45.	____
73.02.03.02	6.	C ____	73.02.03.06	26.	A ____		46.	____
	7.	C ____		27.	B ____		47.	____
	8.	D ____		28.	D ____		48.	____
	9.	B ____		29.	A ____		49.	____
	10.	B ____		30.	D ____		50.	____
3.02.03.03	11.	C ____	73.02.03.07	31.	C ____		51.	____
	12.	D ____		32.	C ____		52.	____
	13.	D ____		33.	D ____		53.	____
	14.	B ____		34.	B ____		54.	____
	15.	C ____		35.	D ____		55.	____
73.02.03.04	16.	D ____	73.02.03.08	36.	D ____		56.	____
	17.	A ____		37.	A ____		57.	____
	18.	D ____		38.	A ____		58.	____
	19.	C ____		39.	D ____		59.	____
	20.	D ____		40.	C ____		60.	____

File Code: 73.02.04.00.A2-1

Date Published: 7/16/75

Mountain-Plains Education &
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Learning Experience Guide

UNIT: FIXTURES

RATIONALE:

Fixtures make up a very important part of a plumbing system. Fixtures have at least two important functions. They are: (1) ease of use, and (2) appearance. It is the responsibility of the plumber to install fixtures in such a way that they look good and are easy to use. This unit will provide the necessary training you will need to install, service and repair various plumbing fixtures so that they comply with established specifications and codes.

PREREQUISITES:

Prerequisites for this unit are the same as for the course. See the course LEG.

OBJECTIVES:

Measure, lay out and install plumbing fixtures according to specifications following safe practices and procedures.

Install and service traps, faucets, waster, strainer and overflower as specified.

Identify procedures for measuring, laying out, preparing and installing plumbing fixtures.

Identify the procedures for installing and servicing traps and sink or vanity accessories.

RESOURCES:

Printed Materials

Blueprint Reading for Plumbers: Residential and Commercial. D'arcangelo, Delmar Publishers, 1973.
Collection of manufacturer's specification sheets.
Collection of plumbing supply catalogs.
Montana State Plumbing Code.
Plumbers and Pipe Fitters Library: Drainage, Fittings, Fixtures, Volume 2. Jules Oravetz, Sr., Theodore Audel and Company, 1967.
Related Information Plumbing 1. Harry Slater, Delmar Publishers, 1958.
Related Information Plumbing 2. Harry Slater, Delmar Publishers, 1959.
Rough-in Book for Fixtures (Published by fixture manufacturers.).
The Know-How of Wards Simplified Plumbing, (Modern, Easy-to-Install Water and Drainage Systems). Montgomery Wards.

Principal Author(s):

Arneson, Bundy, Frisbee

RESOURCES: continued

Equipment

Cutter, pipe, plastic.
Cutter, pipe, soil.
Drill, electric.
Furnace, lead melting.
Hard hats.
Irons, caulking.
Irons, yarning.
Ladle, lead handling.
Pot, lead.
Threader/Reamer/Cutter, pipe, power combination.
Tools, basic (plumber): bit, drill (set) (1/16 to 1/4 inch)
- box, tool
- chalk line
- cutter, tubing (1/8 to 5/8 inch)
- cutter, tubing (imp)
- flaring tool.
- hacksaw.
- hammer, claw (16 oz.)
- plier, channel lock
- rule, steel (12 ft.)
- screwdriver (4 in one)
- square, combination (12 inch)
- wrench, Allen (set)
- wrench, open-end, adjustable (6 and 8 inch)
- wrench, open-end/box, combination (3/8 to 3/4
- wrench, pipe (12 inch)

Torch and tank, Presto Lite or equivalent.
Wrench, basin.

GENERAL INSTRUCTIONS:

This unit consists of fourteen Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

(1) Read the first assigned Learning Activity Package (LAP).
(2) Begin and complete the first assigned LAP.
(3) Take and score the LAP test.
(4) Turn in the LAP test answer sheet.
(5) Determine the reason for any missed items on the LAP test.
(6) Proceed to and complete the next assigned LAP in the unit.
(7) Complete all required LAPs for the unit by following steps 3 through 6.
(8) In this Unit, there are some LAPs that have tests combined with other LAP tests. These combined tests are taken after completing the last LAP covered by the test.
(9) Take the unit tests as described in the Unit LEG "Evaluation Procedures".
(10) Proceed to the next assigned course.

PERFORMANCE ACTIVITIES:

.01 Trap and Faucet Connections
.02 Faucet Nomenclature and Repair
.03 Tub Waste and Overflow Nomenclature, Function and Installation
.04 Sink Strainer and Overflow Nomenclature and Installation
.05 Fixture Supports
.06 Installing Kitchen Sink
.07 Garbage Disposal Installation
.08 Installing Vanity Lavatory
.09 Installing Wall Hung Lavatory
.10 Installing Bathtub
.11 Installing Shower Cabinet
.12 Installing Free Standing Toilet
.13 Installing Wall Hung Toilet
.14 Installing and Servicing Water Softeners

EVALUATION PROCEDURE:

When pretesting:

1. The student takes the unit multiple-choice pretest.

2. Successful completion is 4 out of 5 items for each LAP part of the pretest.

3. The student then takes a unit performance test if the unit pretest was successfully completed.

4. Satisfactory completion of the performance test is meeting the criteria listed on the performance test.

When post testing:

1. The student takes a multiple-choice unit post test and a unit performance test.

2. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

Since this is the last unit in the Plumbing occupational training area, you will have to complete both a written and a performance test for the occupation. Therefore, prior to taking the tests, you may want to review the units you have already completed. Also, be sure that you have totalled up the time spent in each unit on your Student Progress Record.

Go to the first assigned Learning Activity Package (LAP) listed on your Student Progress Record (SPR).

Student: ______________________ **File Code:** 73.02.04.00.A2-2

Date: ______________________ **Date Published:** 11/27/74

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UNIT PRETEST: FIXTURES

73.02.04.01

1. Which of the following joints is preferred for water supply pipes to faucets?

   a. slip joint
   b. ground joint
   c. sweat joint
   d. screwed joint

2. Which of the following should be placed between the tail pieces and the strainer of a sink strainer?

   a. oakum
   b. solder
   c. washer
   d. pipe dope

3. Which of the following joints requires accurate and smooth finish machining on its surfaces?

   a. ground joint
   b. slip joint
   c. welded joint
   d. soldered joint

4. What type of valve is used on a speedway lavatory supply?

   a. globe
   b. compression
   c. gate
   d. self-closing

5. What type of joint is illustrated in Diagram 31?

   a. screwed joint
   b. ground joint
   c. flare joint
   d. slip joint

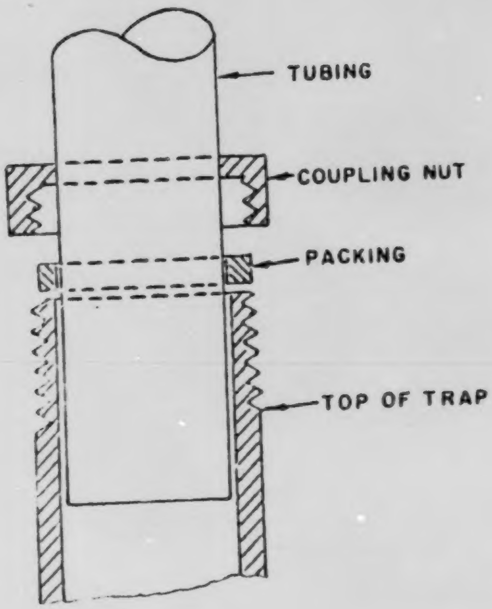
TUBING
COUPLING NUT
PACKING
TOP OF TRAP

Diagram 31

73.02.04.02

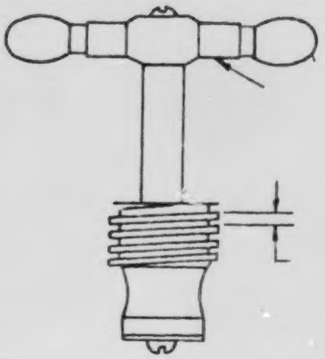

Diagram 34 Fig. 1 -

6. What type of faucet stem is represented in Diagram 34?

   a. gate
   b. globe
   c. compression
   d. quick precision

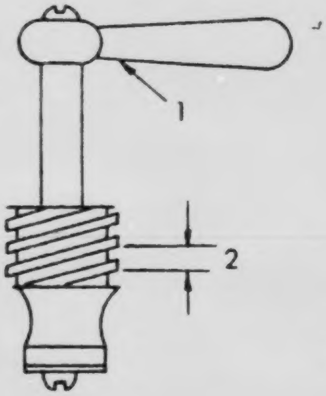

Fig. 2

Diagram 33

7. What type of faucet stem is represented in Diagram 33, Figure 2?

   a. self-closing
   b. compression
   c. quick precision
   d. gate

8. Which of the following is not a type of handle commonly found on sink and laundry faucets?

   a. tee
   b. wheel
   c. cross
   d. lever

73.02.04.02 (continued)

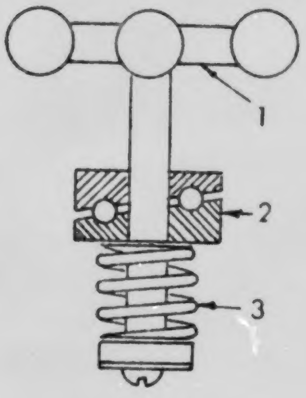

Fig. 3

9. What type of faucet stem is represented in Diagram 33, Figure 3?

   a. self-closing
   b. quick precison
   c. compression
   d. globe

10. In figure number 3, what is identified by number 3?

   a. inclined plane
   b. threads
   c. pitch
   d. spring

73.02.04.03

11. The waste and overflow pipe dimensions are measured how?

   a. inside diameter
   b. outside diameter
   c. circumference
   d. there is no uniform standard of measurement

12. Of what material is the speedway supply pipe made?

   a. brass
   b. stainless steel
   c. annealed copper
   d. chromium

13. How are the joints in a connected waste and overflow sealed?

   a. by using solder
   b. by using a washer
   c. by using a flare joint
   d. by using grease

73.02.04.03 (continued)

14. On a connected waste and overflow, what holds the top elbow in place?

   a. solder
   b. brass nut
   c. set screw
   d. putty

15. What is the minimum size of a bath waste?

   a. 1½ inches
   b. 1 inch
   c. 2 inches
   d. 1¼ inches

73.02.04.04

16. Of what metal are strainers made?

   a. brass
   b. aluminum
   c. copper
   d. iron

17. In the illustration of the duplex sink strainer (Diagram 35), which number would correspond to the strainer? (Use the diagram on page 6.)

   a. 5
   b. 7
   c. 6
   d. 1

18. Which of the following tools should be used to tighten the nut on a patent overflow?

   a. pipe wrench
   b. lock pliers
   c. monkey wrench
   d. water pump pliers

19. In the illustration of the P. O. plug which number would correspond to the locknut? (Use the diagram on page 7, Diagram 36.)

   a. 3
   b. 1
   c. 2
   d. 4

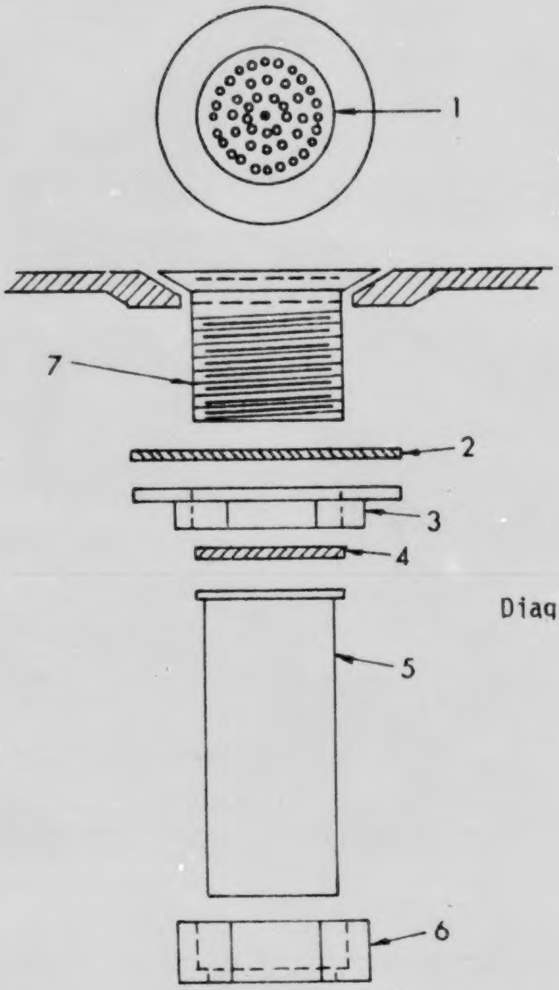

Diagram 35

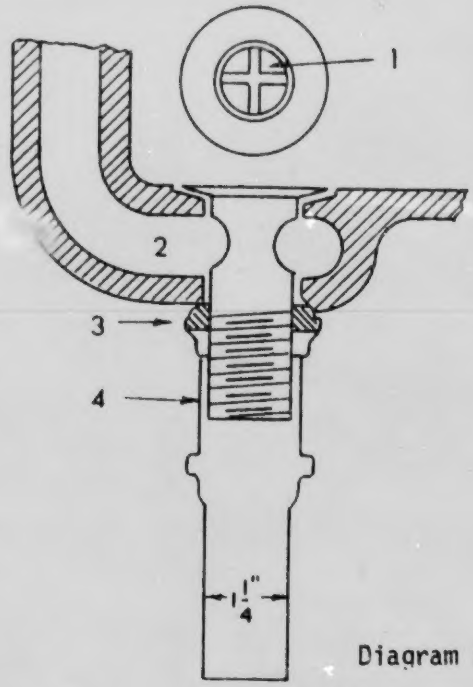

Diagram 36

73.02.04.04 (continued)

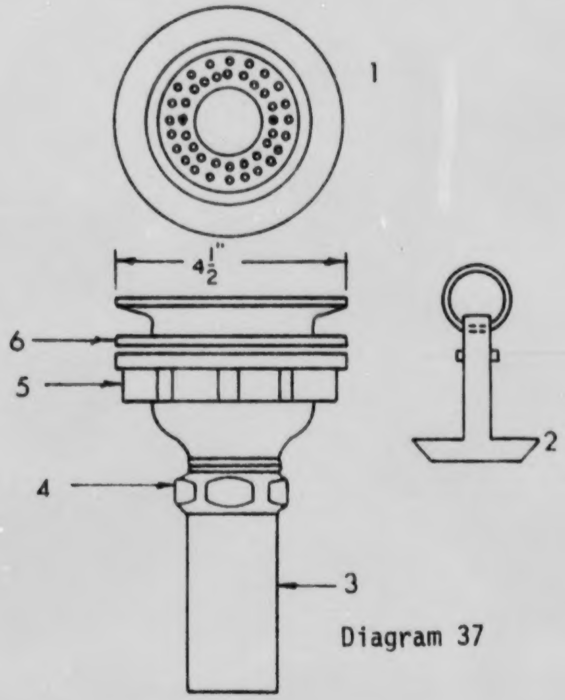

Diagram 37

20. In the illustration of a strainer with a plug (Diagram 37, Figure 2), which number would correspond to the coupling nut?

    a. 5
    b. 4
    c. 3
    d. 6

73.02.04.05

21. Usually, how much lower is the mounting bracket on a wall hung sink than the top of the fixture itself?

    a. 1½ inches
    b. 3 inches
    c. 5 inches
    d. 6 inches

22. When mounting the bracket for a wall hung sink, which screw should be inserted first?

    a. it makes no difference
    b. left hand
    c. right hand
    d. center

73.02.04.05 (continued)

23. Where would you find out what is to be the height of a particular fixture?

    a. from city engineers
    b. from home owners
    c. from blueprints
    d. from fixture specifications

24. After installing the first screw in a wall hung sink bracket, what is the next step?

    a. install the rest of the screws
    b. hang the sink
    c. level the bracket
    d. install the trap

25. Which of the following is an accepted height for a sink?

    a. 30 inches
    b. 36 inches
    c. 24 inches
    d. 44 inches

73.02.04.06

26. Approximately how high off a finished floor should the waste be roughed-in?

    a. 12 inches
    b. 24 inches
    c. 6 inches
    d. 18 inches

27. What size supply lines are usually run to a sink?

    a. 3/8 inch
    b. 1/2 inch
    c. 3/4 inch
    d. 1 inch

28. What is the standard counter top height in a typical kitchen?

    a. 28 inches
    b. 42 inches
    c. 44 inches
    d. 36 inches

73.02.04.06

29. When should the faucets be installed in a typical sink installation?

    a. after clips have been tightened
    b. last
    c. just before turning on the water supply
    d. before sink is dropped in its opening

30. Under what conditions would an island sink installation require a two pipe drainage system?

    a. If the run to the stock is over 8 feet away.
    b. If it is over 3 feet wide.
    c. If it has a garbage disposal.
    d. If pipe size is less than 1 inch.

73.02.04.07

31. What type of tool should be used to turn the nuts on a slip joint used on a garbage disposer installation?

    a. pipe wrench
    b. monkey wrench or chanel locks
    c. lock pliers
    d. socket

32. If a septic tank system has a grease trap and you wish to install a garbage disposer, what should be done?

    a. Install the grinder directly in front of the trap.
    b. Do not install the grinder.
    c. By-pass the grease trap.
    d. Connect the grinder so that it operates at a higher voltage.

33. What size piping is required for most disposer installations?

    a. 1-1/2 inch
    b. 1-1/4 inch
    c. 1-3/4 inch
    d. 1 inch

34. Which of the following should be avoided when installing a garbage disposer?

    a. island sink installations
    b. pipe connections larger than 2 inches
    c. long horizontal drainage runs
    d. corner sink installations

73.02.04.07 (continued)

35. What type of joint is usually found on the waste connections of a garbage disposer?

    a. welded joint
    b. ground joint
    c. screwed joint
    d. slip joint

73.02.04.08

36. What is the typical center-to-center measurement of a set of faucets for a vanity sink?

    a. 4 inches
    b. 8 inches
    c. 7 inches
    d. 9 inches

37. What is the standard height for a bathroom vanity?

    a. 32 inches
    b. 36 inches
    c. 28 inches
    d. 24 inches

38. When roughing-in a vanity sink, what height off the floor should the drain pipe be installed?

    a. 18 inches
    b. 12 inches
    c. 14 inches
    d. 22 inches

39. What size waste pipe is usually installed on a vanity sink?

    a. 1-1/4 inch
    b. 1-1/2 inch
    c. 1 inch
    d. 3/4 inch

40. Which of the following fittings would be used to project a water supply system out past the finished wall when roughing-in a vanity sink?

    a. nipple
    b. 90° ell
    c. tee
    d. gee

73.02.04.09

41. What is the standard height of the top of a wall-hung sink?

    a. 32 inches
    b. 24 inches
    c. 28 inches
    d. 36 inches

42. What size supply piping should be roughed-in for a wall-hung sink?

    a. 1 inch
    b 1/4 inch
    c. 1/2 inch
    d. 3/4 inch

43. What is on the center distance drilling for faucets on a standard wall-hung sink?

    a. 12 inch O.C.
    b. 6 inch O.C.
    c. 8 inch O.C.
    d. 4 inch O.C.

44. Which of the following is not a description of a faucet that would be used on a typical wall-hung sink?

    a. Moen single control 4 inch O.C.
    b. U/R Dual Control 4 inch O.C.
    c. Moen single lever 8 inch O.C.
    d. U/R Single Control 4 inch O.C.

45. Which of the following is the correct measurement from the finished floor for a typical wall-hung sink supply rough in dimension?

    a. 6 inches
    b. 12 inches
    c. 16 inches
    d. 21 inches

73.02.04.10

46. A bath tub must have, for support reasons, which of the following on or into the outside framing?

    a. screws
    b. blocks
    c. bolts
    d. brackets

73.02.04.10 (continued)

47. When should a tub be installed?

    a. after sheetrock is installed
    b. after complete finishing of bathroom
    c. before final completion of bathroom framing
    d. after finish floor is installed

48. Approximately how much over actual tub size should the framing be?

    a. 1/2 inch
    b. none should be allowed
    c. 1-1/2 inch
    d. 2 inches

49. If you are required to install a shower-tub combination, what is the recommended height of the shower rough nipple from the finish floor?

    a. 5'0"
    b. 6'0"
    c. 4'6"
    d. 7'0"

50. If you are required to install a tub faucet, what is the recommended height of the rough nipple above the tub rim?

    a. 10 inches
    b. 4 inches
    c. 2 inches
    d. 1 foot

73.02.04.11

51. What size drain pipe is commonly used on a shower?

    a. 2 inch
    b. 1-1/4 inch
    c. 1-1/2 inch
    d. 3 inch

52. Which of the following traps should be used on most shower installations?

    a. 1-1/2 inch drum trap
    b. 2 inch S trap
    c. 2 inch P trap
    d. 1 inch S trap

73.02.04.11

53. What is the recommended rough-in measurement for the rough nipple that is used on a shower head from the finish floor?

    a. 4'0"
    b. 5'0"
    c. 4'6"
    d. 6'0"

54. In most situations, when in the construction procedure should a metal cabinet be installed?

    a. before sheetrocking
    b. before framing
    c. after the sheetrock installation
    d. before insulation installation

55. Which of the following must be installed first when making a metal shower installation?

    a. back
    b. right side
    c. left side
    d. shower base

73.02.04.12

56. What type of gasket is generally used to set toilet?

    a. none
    b. leather gasket
    c. wax ring
    d. cement

57. What is the most common type of closet bowl?

    a. wash down with jet
    b. common wash down
    c. siphon jet
    d. reverse trap

58. What controls the water level and input for a tank type stool?

    a. sill cock
    b. compression stop
    c. ball cock
    d. gate valve

73.02.04.12 (continued)

59. How is a bowl generally fastened to the floor?

    a. A floor flange designed to hold two upright bolts, bowl is then set on flange and nuts applied to secure bowl.
    b. Bowl is screwed on floor flange.
    c. Bowl is held in place by wax ring.
    d. Bowl does not have to be fastened.

60. What connects a wall-hung tank to the bowl?

    a. galvanized elbow
    b. water closet elbow
    c. hose and gasket
    d. screwed pipe

73.02.04.13

61. What is the name of the equipment used to attach a wall-mounted toilet to the wall?

    a. wooden bracket
    b. stool support
    c. foot
    d. chair carrier

62. How many bolts are necessary to mount a wall-hung stool?

    a. two
    b. three
    c. four
    d. six

63. How far should outlet coupling extend through finished wall?

    a. 5/16 inch
    b. 9/16 inch
    c. 3/4 inch
    d. 1 inch

64. What are the approximate water supply roughing measurements for a wall-hung toilet?

    a. 5 inches from finished floor and 6 inches from center of bowl.
    b. 10 inches from finished floor and 6 inches right from center of bowl.
    c. 4 inches from finished floor and 5 inches from center of bowl.
    d. 10 inches from finished floor and 6 inches left from center of bowl.

73.02.04.13 (continued)

65. Should a wall-hung stool be hung before wall is finished?

a. always
b. never
c. it depends on the blueprints
d. it doesn't make any difference when it is hung

73.02.04.14

66. What fixtures should be by-passed by the water softener?

a. kitchen sink
b. stool
c. bath tub
d. lavatory

67. What is the maximum water pressure for a water softener?

a. 125 lbs. PSI
b. 200 lbs. PSI
c. 50 lbs. PSI
d. 100 lbs. PSI

68. Why should a by-pass valve be installed on a water softener?

a. to cut installation costs
b. to mix hard and soft water
c. to save on soft water
d. so water can be provided while servicing softener

69. What is the lowest room temperature at which a softener can be installed?

a. 45 degrees
b. 32 degrees
c. 10 degrees
d. zero degrees

70. After a softener is installed, what would cause a drop in water pressure?

a. Soft water will loosen mineral deposits and clog aerators reducing pressure.
b. Soft water doesn't need as much water pressure.
c. Soft water doesn't compress.
d. Softeners have minerals that reduce water pressure.

UNIT TEST ANSWER SHEET

(Unit Pretest Answer Key)

Occupational Area: ______

File Code: 73.02.04.00.A2-2

Name: ______

ANSWERS

73.02.04.01	1. B ______	73.02.04.05	21. A______	73.02.04.09	41. A______
	2. C ______		22. D______		42. C______
	3. A ______		23. D______		43. D______
	4. B ______		24. C______		44. C______
	5. D ______		25. B______		45. D______
73.02.04.02	6. C ______	73.02.04.06	26. D______	73.02.04.10	46. B______
	7. C ______		27. B______		47. C______
	8. B ______		28. D______		48. A______
	9. A ______		29. D______		49. B______
	10. D ______		30. C______		50. B______
73.02.04.03	11. B ______	73.02.04.07	31. B______	73.02.04.11	51. A______
	12. C ______		32. C______		52. C______
	13. B ______		33. A______		53. D______
	14. C ______		34. C______		54. C______
	15. A ______		35. D______		55. D______
73.02.04.04	16. A ______	73.02.04.08	36. B______	73.02.04.12	56. C______
	17. D ______		37. A ______		57. D______
	18. C ______		38. C ______		58. C______
	19. D ______		39. B ______		59. A______
	20. B ______		40. A ______		60. B______

UNIT TEST ANSWER SHEET

(Unit Pretest Answer Key)

Occupational Area: ______
File Code: 73.02.04.00.A2-2
Name: ______

ANSWERS

73.02.04.13 61. D ______
62. C ______
63. A ______
64. D ______
65. B ______
3.02.04.14 66. B ______
67. D ______
68. D ______
69. B ______
70. A ______
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119. ______
120. ______

File Code: 73.02.04.01.A2-0

Date Published: 7/16/75

Mountain-Plains Education &
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Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student:

Date:

PERFORMANCE ACTIVITY: Trap and Faucet Connections

OBJECTIVES:

Recognize methods of connecting traps and faucets to various fixtures.

Connections are made following manufacturer's specifications using appropriate tools and procedures.

EVALUATION PROCEDURE:

Successful completion of this LAP will be determined by correctly answering 8 out of 10 items on a multiple-choice test.

Trap and faucet connections are evaluated on the unit performance test.

RESOURCES:

Related Information Plumbing 1, Slater.

Plumbers and Pipe Fitters Library: Drainage, Fittings, Fixtures, Volume 2. Oravetz.

Collection of manufacturer's specification sheets.

Basin wrench.
Faucets.
Fixtures.
Hand tools.
Torch.
Traps.

PROCEDURE:

1. Using Related Information Plumbing 1, do the following assignments:
    a. Read pages 180-181.
    b. Answer the questions on page 182.

Principal Author(s):

Arneson, Bundy, Frisbee

PROCEDURE: continued

1. c. Check your answers with the answer key. If all your answers are correct proceed to step 2.

If some of your answers do not agree, review the material in the text.

If you still have problems, use Plumbers and Pipe Fitters Library: Drainage, Fittings, Fixtures and read the following pages:

30-40 and 42	Traps
229 and 237	Faucets
52	Grease Traps

If you have any further problems, contact the instructor.

2. Have the instructor identify the size and type of traps and faucets **to be connected:**

TRAP	#1	#2
Size	______	______
Type	______	______

FAUCET	#1	#2
Size	______	______
Type	______	______

3. Obtain the tools and supplies needed to make trap and faucet connections, then proceed to the designated workstation.

4. Make the connections required for various trap and faucet assemblies.

5. After installation, check with the instructor for evaluation.

6. When the instructor has evaluated your last connection, take the LAP test.

7. Score and return the LAP test.

8. If the LAP test is satisfactory, begin the next assigned LAP.

If the LAP test is unsatisfactory, proceed as directed by the instructor.

Student: ____________________ File Code: 73.02.04.01.A2-2

Date: ____________________ Date Published: 12/2/74

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Glasgow AFB, Montana 59231

LAP TEST: TRAP AND FAUCET CONNECTIONS

1. If you lost the rubber washer for a slip joint, what could be used in its place?

   a. lampwick or graphite packing
   b. pipe dope
   c. fiber glass packing
   d. steel wool packing

2. Which of the following joints would not be used on a supply line?

   a. welded joint
   b. sweat joint
   c. screwed joint
   d. slip joint

3. Which of the following joints is preferred for water supply pipes to faucets?

   a. slip joint
   b. ground joint
   c. sweat joint
   d. screwed joint

4. Which of the following should be placed between the tail pieces and the strainer of a sink strainer?

   a. oakum
   b. solder
   c. washer
   d. pipe dope

5. What should you do if a mistake has been made in rough-in? For example, the O.C. center on the rough-in is 8 inches and the faucet O.C. is 6 inches.

   a. obtain a different faucet
   b. remove and replace the rough-in installation
   c. use soft copper supplies
   d. use flexible supplies

6. Upon which of the following does the lower end of the supply pipe depend for a water tight joint?

   a. pipe dope
   b. proper flare
   c. sleeve
   d. seat

7. What type of valve is used on a speedway lavatory supply?

   a. globe
   b. compression
   c. gate
   d. self-closing

8. What type of joint is illustrated in figure 3 (Diagram 32), that will be used to connect to faucets? (Use the diagram below.)

   a. flare joint
   b. slip joint
   c. compression joint
   d. ground joint

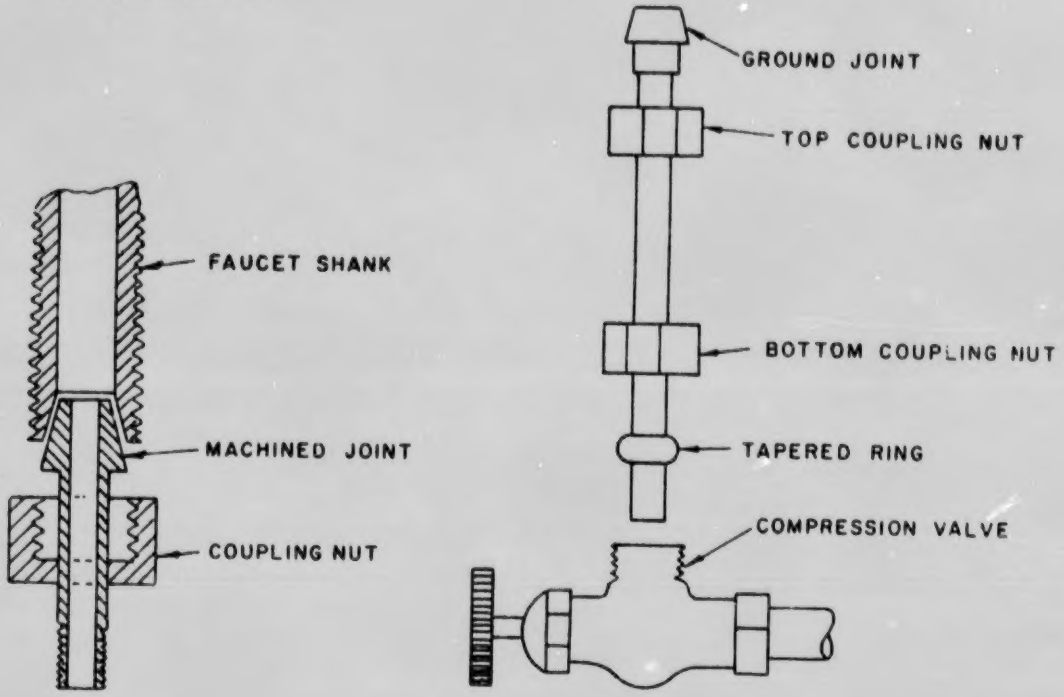

FAUCET SHANK
MACHINED JOINT
COUPLING NUT
GROUND JOINT
TOP COUPLING NUT
BOTTOM COUPLING NUT
TAPERED RING
COMPRESSION VALVE

Fig. 2 Fig. 3

Diagram 32

9. What type of joint is illustrated in figure 1, Diagram 31? (Use the diagram below.)

   a. screwed joint
   b. ground joint
   c. flare joint
   d. slip joint

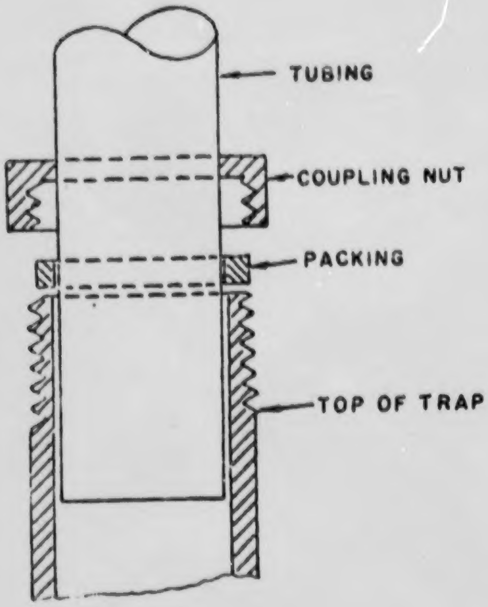

TUBING
COUPLING NUT
PACKING
TOP OF TRAP

Diagram 31

10. What type of joint is illustrated in Diagram 32, Figure 2?

a. compression joint
b. slip joint
c. flare joint
d. ground joint

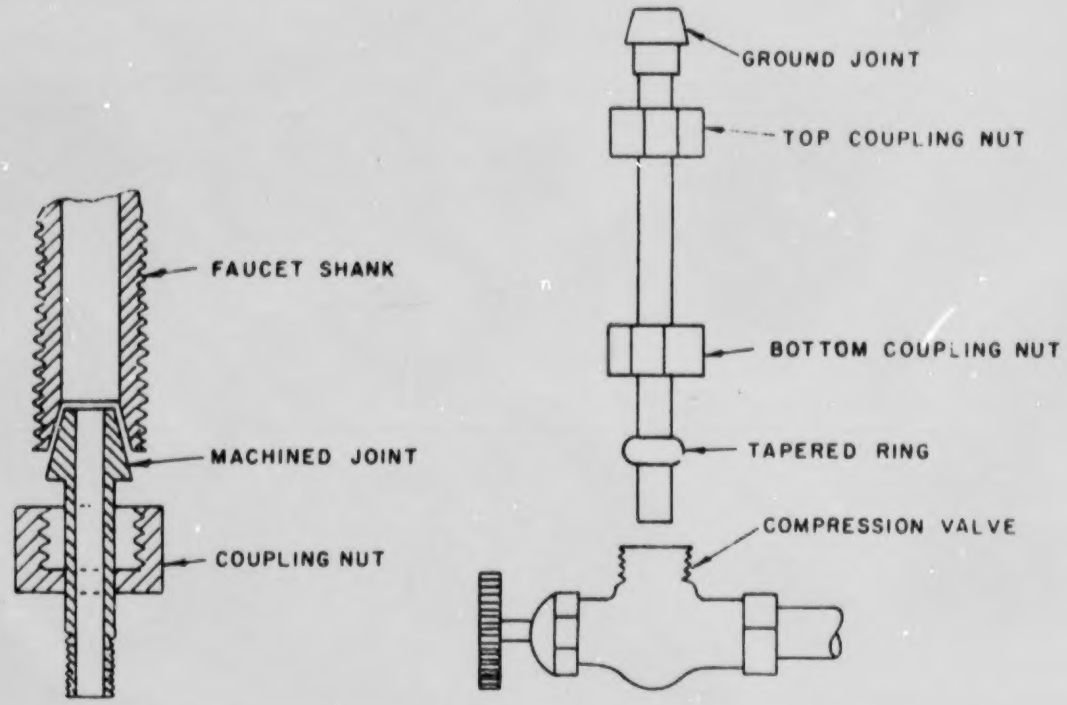

FAUCET SHANK
MACHINED JOINT
COUPLING NUT
GROUND JOINT
TOP COUPLING NUT
BOTTOM COUPLING NUT
TAPERED RING
COMPRESSION VALVE

Fig. 2 Fig. 3

Diagram 32

LAP TEST ANSWER KEY: TRAP AND FAUCET CONNECTIONS

1. A
2. D
3. B
4. C
5. D
6. C
7. B
8. D
9. D
10. D

File Code: 73.02.04.02:A2 0

Date Published: 7-16-75

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: __________

Date: __________

PERFORMANCE ACTIVITY: Faucet Nomenclature and Repair

OBJECTIVES:

Identify types of faucets by the way they function.

Make faucets servicable by following acceptable procedures and using appropriate tools.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Tub Waste and Overflow Nomenclature, Function and Installation" LAP test and is taken after completing that LAP.

Repairs on faucets make them serviceable according to manufacturer's specifications.

RESOURCES:

Manufacturer's specifications.

Related Information Plumbing 1, Slater.

Electric drill.
Faucets.
Hand tools.

PROCEDURE:

1. Using Related Information Plumbing 1, do the following assignments:
    a. Review Unit 55.
    b. Answer the questions on page 185.
    c. Check your answers with the answer key. Determine the reason for any differences between the answer key and your anwers.

Principal Author(s): Arneson, Bundy, Frisbee

PROCEDURE: (continued)

2. Read the following:

A LEAKY FAUCET

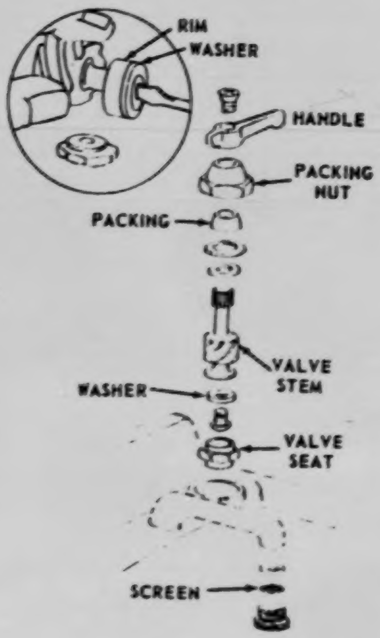
If faucet drips the compression-type valve is not closing properly. Replace the washer, using one of exact size to fit into the valve-stem seat. (It is advisable to keep on hand a box of assorted washers, preferably cone-shaped, for this purpose). To reach the washer, remove handle, pakcing nut and valve-stem, which backs up and out after nut is removed.

If washer isn't solely at fault, the valve seat may be out-of-round or scored. This often can be corrected by reaming the seat. Special reamers, with instructions, are available -- or you can use an electric drill with a fine-grain cone-shaped abrasive point. In either case, be very careful to remove as little as possible of the soft valve-seat metal -- and to thoroughly wash away all chips before reassembling the faucet. As a last recourse, screw out the valve seat and replace it with an identical one.

If water leaks around the stem, the packing is loose or worn out. Try tightening the packing nut. If this doesn't do, remove the nut, dig out the packing -- and replace with a new identical packing (or, you can make a packing by winding a tightly rolled strand of lead wood uniformly around the stem, to be compressed inside the nut when this is tightened).

3. Examine Figure 1, an illustration of the single control faucet.

FIGURE 1: A TYPICAL FAUCET ASSEMBLY



PROCEDURE: continued

4. Go to the faucet repair workstation. Service and repair a single control faucet.
5. Review the data sheet for the faucet to be serviced.
6. Diassemble the faucet. Identify and label all the parts.
7. Have the instructor check your labeling.
8. When the instructor gives approval to proceed, service and assemble the the single control faucet, do so.
9. Repeat steps 4 through 8 on the dual control faucet.
10. Go to the next assigned LAP.

File Code: 73.02.04.03.A2-0

Date Published: 7/16/75

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Tub Waste and Overflow Nomenclature, Function and Installation

OBJECTIVES:

Identify types of tub waste and overflow connections.

Install waste and overflow connections according to specifications using appropriate tools and procedures.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

Installation is made as specified.

RESOURCES:

Plumbers and Pipe Fitters Library: Drainage, Fittings, Fixtures, Volume 2, Oravetz.

Related Information Plumbing 1, Slater.

Hand tools.

PROCEDURE:

1. Using Related Information Plumbing 1, do the following assignments:
   a. Read Unit 56.
   b. Answer the questions on pages 187 and 188.
   c. Check your answers with the answer key. Determine the reason for any differences between your answer and the answer key. If you need help, ask the instructor.
2. Using Plumbers and Pipe Fitter Library: Drainage, Fittings, Fixtures, read pages 259-263. Pay attention to the various types of wastes and overflow.

Principal Author(s):

Arneson, Bundy, Frisbee

PROCEDURE: continued

3. Have the instructor assign the type and size of waste to be installed.

WASTE AND OVERFLOW	#1	#2
Type		
Size		

4. Go to the workstation. Obtain the tools and supplies needed to install a tub waste and overflow. Follow the manufacturer's directions carefully as you make the installation.

5. When you have completed the installation, check with the instructor for evaluation.

6. If the installation is satisfactory, take the LAP test.

   If the installation is unsatisfactory, proceed as direced by the instructor.

7. Score and return the LAP test.

8. If the LAP test is satisfactory, begin the next assigned LAP.

   If the LAP test is unsatisfactory, proceed as the instructor directs.

73.02.04.02.A2-2

Student: ______________________ **File Code:** 73.02.04.03.A2-2

Date: ______________________ **Date Published:** 12/2/74

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

LAP TEST: FAUCET NOMENCLATURE AND REPAIR/TUB WASTE AND OVERFLOW NOMENCLATURE, FUNCTION AND INSTALLATION

73.02.04.02

1. Which type of lavatory faucet should be used in a public toilet room?

   a. quick precision
   b. compression
   c. globe
   d. self-closing

2. What is the primary reason for using a self-closing faucet?

   a. cost less
   b. saves water
   c. easier to use
   d. easier to install

3. What type of faucet stem is represented in figure 2, Diagram 33?

   a. self-closing
   b. compression
   c. quick precision
   d. gate

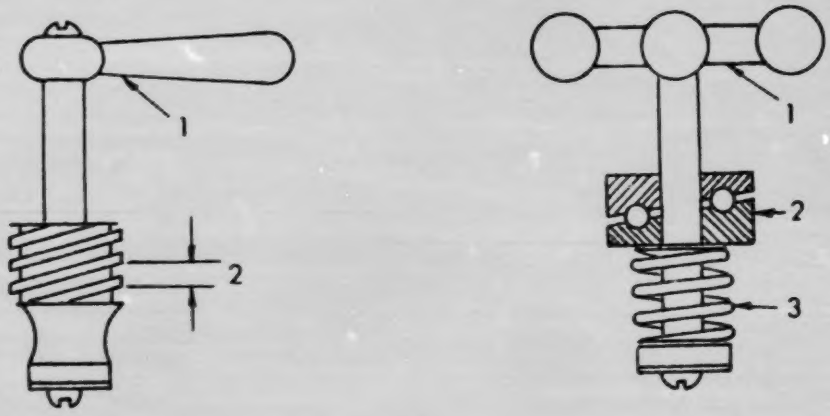

Fig. 2

Fig. 3

Diagram 33

4. Hot water faucets should be:

   a. placed on the right when not facing the sink.
   b. placed on the left when facing the sink.
   c. placed on the right when facing the sink.
   d. all positions are proper.

73.02.04.02 (continued)

5. In figure 2 (Diagram 33), what is represented by the portion labeled number 2? (Use the diagram on page 1.)

   a. valve
   b. thread
   c. spring
   d. pitch of the thread

73.02.04.03

6. If you found a situation in a lavatory that would allow the water to overflow the sink if the stopper was in place, what would you install?

   a. an overflow
   b. by-pass
   c. another drain connection
   d. a self-closing faucet

7. The waste and overflow pipe dimensions are measured how?

   a. inside diameter
   b. outside diameter
   c. circumference
   d. there is no uniform standard of measurement.

8. Of what material is the speedway supply pipe made?

   a. brass
   b. stainless steel
   c. annealed copper
   d. chromium

9. How are the joints in a connected waste and overflow sealed?

   a. by using solder
   b. by using a washer
   c. by using a flare joint
   d. by using grease

10. On a connected waste and overflow, what holds the top elbow in place?

   a. solder
   b. brass nut
   c. set screw
   d. putty

LAP TEST ANSWER KEY: FAUCET NOMENCLATURE AND REPAIR/TUB WASTE AND OVERFLOW NOMENCLATURE, FUNCTION AND INSTALLATION

LAP 02 1. D
2. B
3. C
4. C
5. D

LAP 03 6. A
7. B
8. C
9. B
10. C

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File Code: 73.02.04.04.A2-0

Date Published: 7/16/75

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Sink Strainer and Overflow Nomenclature and Installation

OBJECTIVES:

Identify the types of sink strainers and P.O. plugs.

Install the sink strainer and P.O. plugs in the fixture using appropriate tools and procedures that meet desired specifications.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

The sink strainer and P.O. plug is installed as specified.

RESOURCES:

Related Information Plumbing 1, Slater.

Hand tools.
Strainer.
P.O. plug.

PROCEDURE:

1. Using Related Information Plumbing 1, do the following assignments:
    a. Read carefully the information in Unit 57. Pay close attention to how the patent overflow (P.O.) functions.
    b. Answer the questions on page 191.
    c. Check your answers with the answer key. Determine the reason for any differences between your answers and the answer key. If you have any questions, check with the instructor.
2. Obtain the tools and supplies needed to install the patent overflow plug.
3. Go to the proper workstation and install the P.O. plug according to manufacturer's instructions.

Principal Author(s):

Arneson, Bundy, Frisbee

PROCEDURE: continued

4. Check with your instructor for evaluation.

5. If evaluation is satisfactory, proceed to step 6.

   If evaluation is unsatisfactory, proceed as directed by the instructor.

6. Using Related Information Plumbing 1, do the following assignments:

   a. Read carefully the information on strainers in Unit 58.

   b. Answer the questions on page 94.

   c. Check your answers with the answer key. Determine the reason for any differences between your answer and the answer key. If you have any questions, check with the instructor.

7. Repeat the procedures in steps 2 through 5 for the sink strainers.

8. If the installation of the strainers is satisfactory, take the LAP test.

   If the installation of the strainers is unsatisfactory, proceed as directed by the instructor.

9. Score and return the LAP test.

10. If the LAP test is satisfactory, begin the next assigned LAP.

    If the LAP test is unsatisfactory, proceed as directed by the instructor.

Student: ______________________ File Code: 73.02.04.04.A2-2

Date: ______________________ Date Published: 12/2/74

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LAP TEST: SINK STRAINER AND OVERFLOW NOMENCLATURE AND INSTALLATION

1. On a duplex strainer, how is the tail piece attached to the strainer?

   a. a spring clip is positioned properly
   b. locknut is tightened
   c. a set screw is tightened
   d. coupling nut is tightened

2. Of what metal are strainers made?

   a. brass
   b. aluminum
   c. copper
   d. iron

3. On a duplex strainer, what is first placed on the strainer outside the sink?

   a. the gasket
   b. the locknut
   c. plug
   d. coupler washer

4. In the illustration of the duplex sink strainer (Figure 1, Diagram 35), which number would correspond to the plug? (Use the diagram on page 2.)

   a. 5
   b. 7
   c. 6
   d. 1

5. In the illustration of the duplex sink strainer (Figure 1, Diagram 35), which number would correspond to the lock nut? (Use the diagram on page 2.)

   a. 6
   b. 2
   c. 3
   d. 4

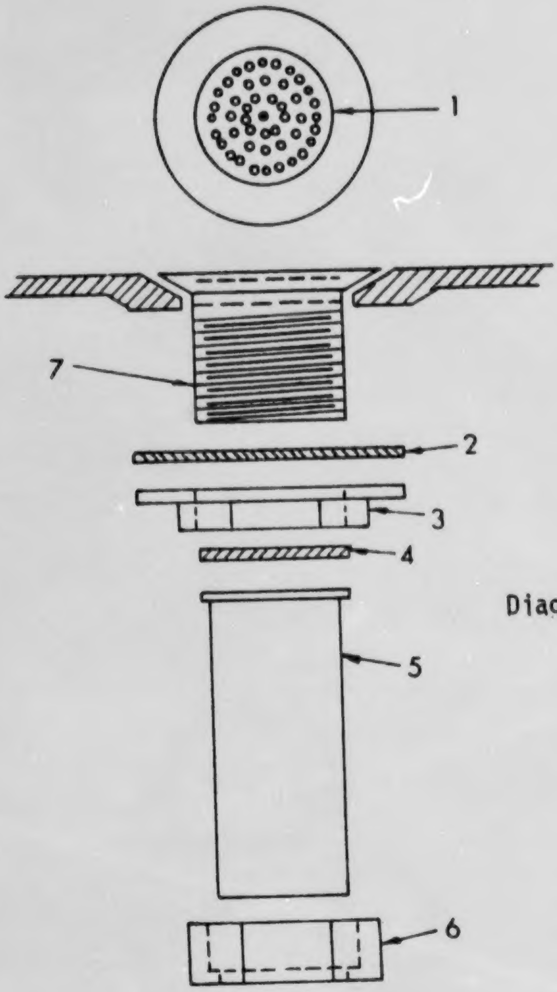

Diagram 35

6. If water leaks out of the basin (to the outside) after a patent overflow has been installed, which of the following would be replaced?

   a. gasket
   b. lock nut
   c. plug
   d. putty

7. In figure 1, Diagram 36 (P.O. Plug), which number would correspond to the strainer? (Use the diagram on page 3.)

   a. 3
   b. 1
   c. 4
   d. 2

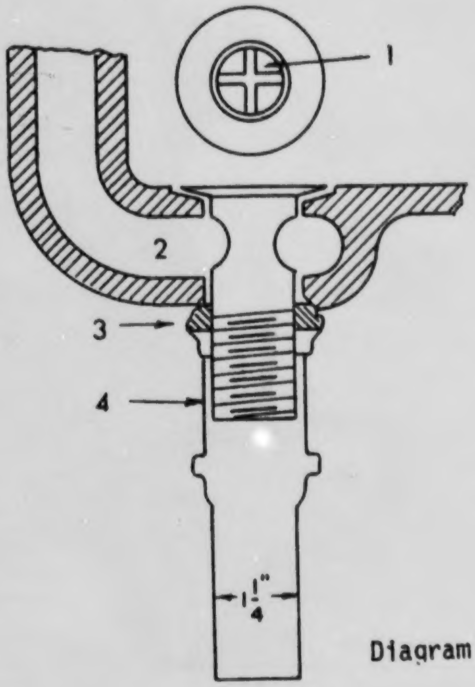

Diagram 36

8. In what direction would you place the holes in the plug inside the overflow of a sink?

   a. toward the right side
   b. toward the openings in the fixture
   c. toward the left side
   d. away from the openings in the fixture

9. In the illustration of the P.O. plug, which number would correspond to the locknut? (Use Diagram 36 above.)

   a. 3
   b. 1
   c. 2
   d. 4

10. In the illustration of a strainer with a plug (Figure 2, Diagram 37), which number would correspond to the gasket? (Use the diagram on page 4.)

   a. 4
   b. 6
   c. 1
   d. 2

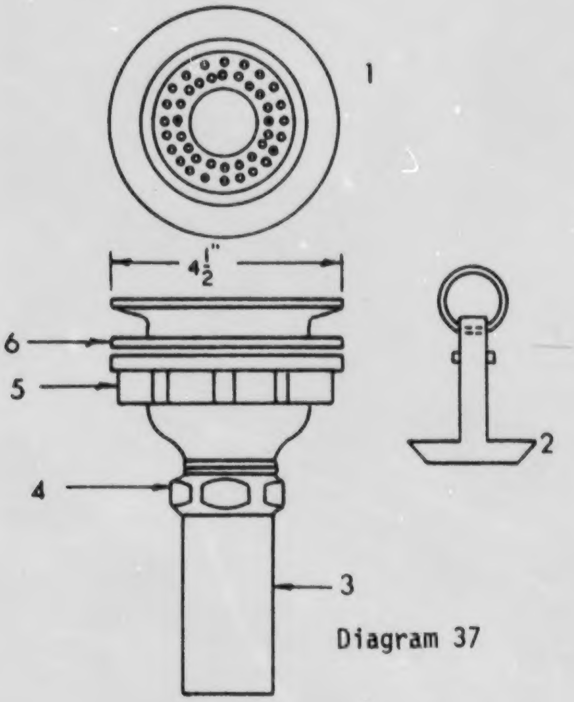

Diagram 37

LAP TEST ANSWER KEY: SINK STRAINER AND OVERFLOW NOMENCLATURE AND INSTALLATION

1. D
2. A
3. A
4. B
5. C
6. D
7. B
8. B
9. D
10. B

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File Code: 73.02.04.05.A2-0

Date Published: 7/16/75

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Fixture Supports

OBJECTIVES:

Install the backing board and brackets that support wall hung plumbing fixtures.

Installation is performed using appropriate tools and following procedures that insure placement of the fixture as specified.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Installing Kitchen Sink" LAP test and is taken after completing that LAP.

Brackets are installed according to given specifications.

RESOURCES:

Related Information Plumbing 1, Slater.

Backing materials.
Fixture brackets.
Hand tools.

PROCEDURE:

1. Using Related Information Plumbing 1, do the following assignments:
    a. Read Unit 59.
    b. Answer the questions on pages 197 and 198.
    c. Check your answers with the answer key. Determine the reason for any differences between your answer and the answer key.
2. Have the instructor assign the fixtures for which you will install the backing and support.

FIXTURE #1____________________

FIXTURE #2____________________

Principal Author(s):

Arneson, Bundy, Frisbee

PROCEDURE: continued

3. Obtain the tools and supplies needed to install backing for plumbing fixtures.
4. Go to the plumbing workstation. There you will be required to install one of the two sets of backing and support brackets for the plumbing fixtures. Work must be neat and meet the standards of a typical installation.
5. When you have completed the installation, have the instructor evaluate it.
6. If the installation is satisfactory, repeat procedures for Steps 3 through 5 for installation of backing and supports.
7. If the installation is satisfactory, proceed to the next assigned LAP.

   If the installation is unsatisfactory, proceed as directed by the instructor.

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File Code: 73.02.04.06.A2-0

Date Published: 7/16/75

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Installing Kitchen Sink

OBJECTIVES:

Install kitchen sink where indicated by the contruction specifications.

The installation is made according to specifications using appropriate tools and procedures.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

Kitchen sink is installed according to given specifications.

RESOURCES:

The Know-How of Wards Simplified Plumbing, Montgomery Wards.

Manufacturer's specifications.

Hand tools.
Basin wrench.

PROCEDURE:

1. Review pages 59 and 60 in The Know-How of Wards Simplified Plumbing.
2. Have the instructor assign a sink and accessories which you are to install.
3. Obtain the supplies, tools and equipment needed to install the sink.
4. Go to the plumbing workstation.
5. Obtain and read the sink manufacturer's specifications carefully before beginning the installation.

   KEY POINT: Use safety procedures while completing the sink installation.

Principal Author(s):

Arneson, Bundy, Frisbee

73.02.04.05.A2-2

Student: ______________________ File Code: 73.02.04.06.A2-2

Date: ______________________ Date Published: 12/2/74

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LAP TEST: FIXTURE SUPPORTS/INSTALLING KITCHEN SINK

73.02.04.05

1. Usually, how much lower is the mounting bracket on a wall hung sink than the top of the fixture itself?

   a. 1½ inches
   b. 3 inches
   c. 5 inches
   d. 6 inches

2. When mounting the bracket for a wall hung sink, which screw should be inserted first?

   a. it makes no difference
   b. left hand
   c. right hand
   d. center

3. Which of the following is usually the on-center spacing of studs in homes?

   a. 48 inch O.C.
   b. 20 inch O.C.
   c. 36 inch O.C.
   d. 16 inch O.C.

4. Where would you find out what is to be the height of a particular fixture?

   a. from city engineers
   b. from home owners
   c. from blueprints
   d. from fixture specifications

5. After installing the first screw in a wall hung sink bracket, what is the next step?

   a. install the rest of the screws
   b. hang the sink
   c. level the bracket
   d. install the trap

73.02.04.06

6. How is the initial line for cutting a sink hole usually accomplished?

   a. use a scriber
   b. measure the sink and then transfer the measurements to the countertop
   c. turn sink upside down on the countertop
   d. use a prick punch and T-square

7. Approximately how high off a finished floor should the waste be roughed-in?

   a. 12 inches
   b. 24 inches
   c. 6 inches
   d. 18 inches

8. Approximately how far off-center should the waste of a typical sink be installed?

   a. 14 inches
   b. 12 inches
   c. 8 inches
   d. 4 inches

9. What is the standard countertop height in a typical kitchen?

   a. 28 inches
   b. 42 inches
   c. 44 inches
   d. 36 inches

10. When should the faucets be installed in a typical sink installation?

    a. after clips have been tightened
    b. last
    c. just before turning on the water supply
    d. before sink is dropped in its opening

73.02.04.05.A2-2
73.02.04.06.A2-2

LAP TEST ANSWER KEY: FIXTURE SUPPORTS/INSTALLING KITCHEN SINK

LAP 05	1.	A
	2.	D
	3.	D
	4.	D
	5.	C
LAP 06	6.	C
	7.	D
	8.	C
	9.	D
	10.	D

PROCEDURE: continued

6. When you have completed the installation, have the instructor evaluate it.
7. If the installation is acceptable, Take the LAP test.

   If the installation is not acceptable, proceed as directed by the instructor.
8. Score and return the LAP test.
9. If the LAP test is satisfactory, begin the next assigned LAP.

   If the LAP test is unsatisfactory, proceed as directed by the instructor.

CHECKLIST: KITCHEN SINK

______________ Proper selection of tools and equipment.

______________ Proper measurements according to manufacturer's specification.

______________ Proper procedures followed as determined by practices and procedures accepted in the industry.

______________ Proper use and care of tools.

______________ Proper assembly of sink.

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Date Published: 7/16/75

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Garbage Disposal Installation

OBJECTIVES:

Install garbage disposal according to manufacturer's specifications using appropriate tools and procedures.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Installing Vanity Lavatory" LAP test and is taken after completing that LAP.

Installation of a garbage disposal unit meets given specifications.

RESOURCES:

Manufacturer's specifications.

Disposal.
Hand tools.

PROCEDURE:

1. Obtain the assigned garbage disposal.
2. Proceed to the workstation and read the manufacturer's specifications and installation instructions for the garbage disposal that was assigned to be installed.
3. Obtain required tools and supplies and install the garbage disposal.
4. Before operating the garbage disposal, have the instructor evaluate the installation.
5. If changes or adjustments are required, complete them.

   If no changes or adjustments are needed, proceed to the next assigned LAP.

Principal Author(s):

Arneson, Bundy, Frisbee

CHECKLIST: INSTALLING GARBAGE DISPOSAL

__________ Proper selection of tools and equipment

__________ Proper procedures followed as determined by practices and procedures accepted in the industry.

__________ Proper use and care of tools.

__________ Proper assembly of disposal.

__________ Safe practices and procedures followed.

File Code: 73.02.04.08.A2-0

Date Published: 7/16/75

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Installing Vanity Lavatory

OBJECTIVES:

Install a vanity lavatory where indicated by the construction specifications.

The installation is made according to specifications using appropirate tools and procedures.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

Installation of vanity lavatory meets given specifications.

RESOURCES:

Plumbers and Pipe Fitters Library: Drainage, Fittings, Fixtures, Oravetz.

The Know-How of Wards Simplified Plumbing, Montgomery Wards.

Manufacturer's specifications.

Hand tools.
Vanity lavatory & accessories.

PROCEDURE:

1. Read pages 57 and 58 in The Know-How of Wards Simplified Plumbing and pages 245-256 in Plumbers and Pipe Fitters Library. Pay attention to methods of installation, types, and rough-in dimensions.
2. Obtain the assigned vanity sink and accessories to be installed.
3. Obtain the tools, equipment and supplies needed and install the vanity lavatory.

   KEY POINT: Valves should be installed on supply lines. This allows for easy sink removal if it becomes necessary.

Principal Author(s):

Arneson, Bundy, Frisbee

PROCEDURE: continued

KEY POINT: Always follow safe practices when working.

4. Have the instructor evaluate the completed installation.

5. Make the necessary corrections if needed.

   If your work is approved, take the LAP test.

6. Score and return the LAP test.

7. If the LAP test is satisfactory, begin the next assigned LAP.

   If the LAP test is not satisfactory, proceed as directed by the instructor.

CHECKLIST: LAYOUT AND INSTALLATION OF VANITY LAVATORY

1. ____________ Fastened properly.
2. ____________ Neat
3. ____________ Square
4. ____________ Measurements are accurate to + or - 1/8 inch
5. ____________ Procedures are accepted in the industry
6. ____________ Meets specifications listed and identified in the blueprint and manufacturer's specifications
7. ____________ Follow safe practices and procedures

73.02.04.07.A2-2

Student: ____________________ File Code: 73.02.04.08.A2-2

Date: ____________________ Date Published: 12/2/74

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Glasgow AFB, Montana 59231

LAP TEST: GARBAGE DISPOSAL INSTALLATION/ INSTALLING VANITY LAVATORY

73.02.04.07

1. What is the minimum size waste a garbage disposer can be connected to?

   a. 1-1/4 inch
   b. 1-1/2 inch
   c. 1 inch
   d. 1-3/4 inch

2. If a septic tank system has a grease trap and you wish to install a garbage disposer, what should be done?

   a. Install the grinder directly in front of the trap.
   b. Do not install the grinder.
   c. By-pass the grease trap.
   d. Connect the grinder so that it operates at a higher voltage.

3. What size piping is required for most disposer installations?

   a. 1-1/2 inch
   b. 1-1/4 inch
   c. 1-3/4 inch
   d. 1 inch

4. Which of the following should be avoided when installing a garbage disposer?

   a. island sink installations
   b. pipe connections larger than 2 inches
   c. long horizontal drainage runs
   d. corner sink installations

5. What type of joint is usually found on the waste connections of a garbage disposal?

   a. welded joint
   b. ground joint
   c. screwed joint
   d. slip joint

73.02.04.08

6. What is the typical center-to-center measurement of a set of faucets for a vanity sink?

   a. 4 inches
   b. 8 inches
   c. 7 inches
   d. 9 inches

7. When roughing-in a vanity sink, what height off the floor should the drain pipe be installed?

   a. 18 inches
   b. 12 inches
   c. 14 inches
   d. 22 inches

8. What size waste pipe is usually installed on a vanity sink?

   a. 1-1/4 inch
   b. 1-1/2 inch
   c. 1 inch
   d. 3/4 inch

9. What size supply lines are usually run to a vanity sink?

   a. 1/2 inch
   b. 3/4 inch
   c. 1 inch
   d. 1-1/4 inch

10. When installing the tail pieces into a vanity sink, a washer should be placed between the tail piece and the sink. If a washer is not available, which of the following would be a substitute?

    a. plumber's putty
    b. oakum
    c. graphite rope
    d. white glue

73.02.04.07.A2-2
73.02.04.08.A2-2

LAP TEST ANSWER KEY: GARBAGE DISPOSAL INSTALLATION/ INSTALLING VANITY LAVATORY

LAP 07 1. B
2. C
3. A
4. C
5. D

LAP 08 6. B
7. C
8. B
9. A
10. D

File Code: 73.02.04.09.A2-0

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Mountain-Plains Education &
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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Installing Wall Hung Lavatory

OBJECTIVES:

Install a wall hung lavatory where indicated by the construction specifications.

Manufacturer's specifications are followed in installation using the appropriate tools and procedures.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Installing Bathtub" LAP test and is taken after completing that LAP.

Installation of wall hung lavatory meets given specifications.

RESOURCES:

Plumbers and Pipe Fitters Library: Drainage, Fittings, Fixtures, Oravetz.

The Know-How of Wards Simplified Plumbing, Montgomery Wards.

Basin wrench.
Hand tools.
Lavatory and accessories.

PROCEDURE:

1. Read pages 57 and 58 in The Know-How of Wards Simplified Plumbing and pages 245-256 in Plumbers and Pipe Fitters Library. Pay attention to methods of installation.

2. Obtain the tools, equipment and supplies needed and install a wall hung lavatory.

   KEY POINT: Valves should be installed on supply lines. This allows for easy sink removal if it becomes necessary.

   KEY POINT: Always follow safe practices when working.

Principal Author(s):

Arneson, Bundy, Frisbee

__PROCEDURE__: continued

3. When you have completed the installation, have the instructor evaluate your job.
4. Make the necessary corrections if needed.

   If your work is approved, proceed to the next assigned LAP.

CHECKLIST: WALL HUNG LAVATORY

1. ____________________Fastened properly
2. ____________________Neat
3. ____________________Square and plumb
4. ____________________Procedures are accepted in the industry
5. ____________________Meets specifications listed and identified in the blueprint and manufacturer's specifications
6. ____________________Follows safe practices and procedures

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Date Published: 7/17/75

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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ______________

Date: ______________

PERFORMANCE ACTIVITY: Installing Bathtub

OBJECTIVES:

Measure, mark and install a bathtub at the location indicated by the construction specifications.

The tub installation is made using appropriate tools and procedures according to given specifications.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

Installation of the bathtub meets given specifications.

RESOURCES:

Manufacturer's specifications.

Basic tools.
Bathtub and accessories.
Pipe and fittings.
Torch.

PROCEDURE:

1. Read the following:

INSTALLING OF A BATHTUB

(1) Determine the correct installation measurements and procedures by referring to the manufacturer's rough-in specifications.

(2) Select and cut two 2-inch x 6-inch blocks long enough to support the tub (see Figure 1, page 2).

Principal Author(s):

Arneson, Bundy, Frisbee

PROCEDURE: continued

(3) Nail 2-inch x 6-inch to studding as shown in Figure 1.

NOTE: The tub can be supported by two different methods. (See Figures 1 and 2)

(4) Move the tub into position.

NOTE: Safety precautions must be followed when handling the tub.

(5) Level the tub as shown in Figure 3.

FIGURE 1: ROUGH-IN FOR BATHTUB (Method Nr 1)

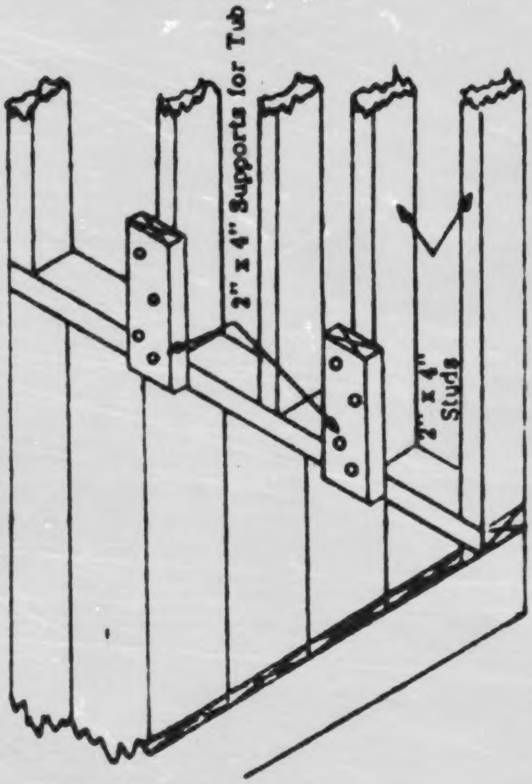

2" x 4" Supports for Tub
2" x 4" Studs

FIGURE 2: ROUGH-IN FOR BATHTUB (Method Nr 2)

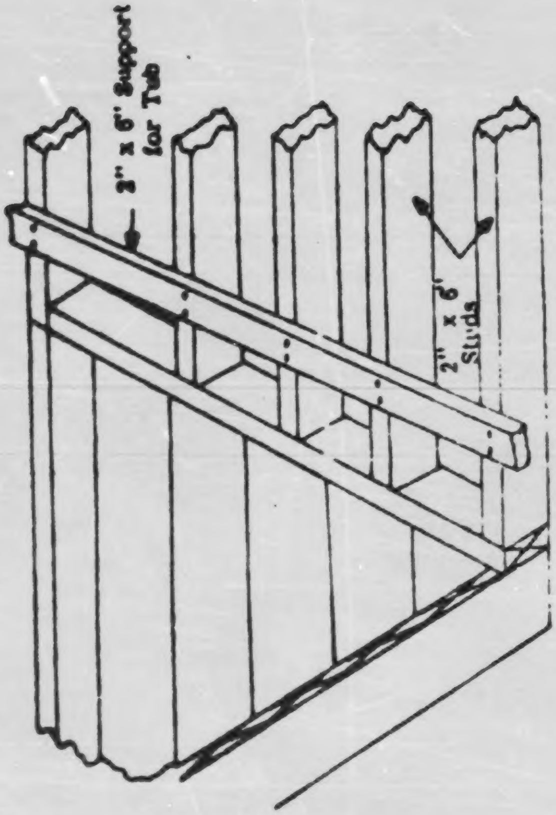
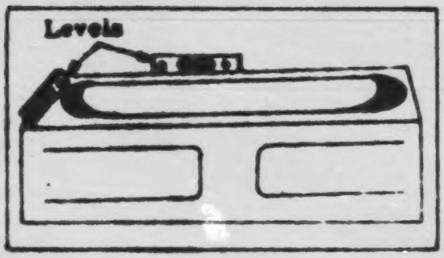

2" x 6" Support for Tub
2" x 6" Studs

FIGURE 3: LEVELING BATHTUB



PROCEDURE: continued

ROUGHING IN TUB FILLER AND SHOWER

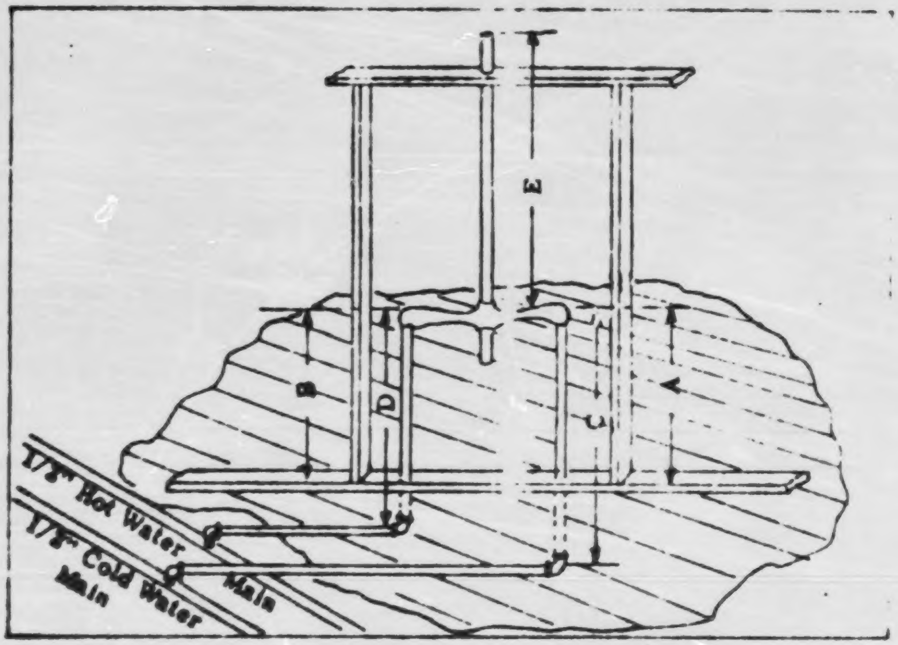
(1) Install risers as indicated in Figure 4, assuring they are the same height.

(2) Install the mixing valves.

(3) Obtain the show riser height (measurement "E" in Figure 4) from the manufacturer's specifications.

(4) Using measurement found in Step 3, install the shower riser.

FIGURE 4: BATHTUB AND SHOW RISERS



INSTALLING WASTE AND OVERFLOW

(1) Attach brass tail piece and overflow tube to the brass tee. (See Figure 5)

NOTE: Do not tighten slip nuts until waste is installed.

(2) Install the tub shoe assembly on the tub using putty and rubber washer to seal the tub drain outlet.

(3) Attach the tub shoe assembly to the brass tee.

PROCEDURE: continued

(4) Attach the overflow through the tub to the overflow tube.

(5) Tighten all connections.

(6) Attach waste and overflow to the drain using a trap.

(7) Turn on water.

(8) Test for leaks in water supply and drain system; repair if necessary.

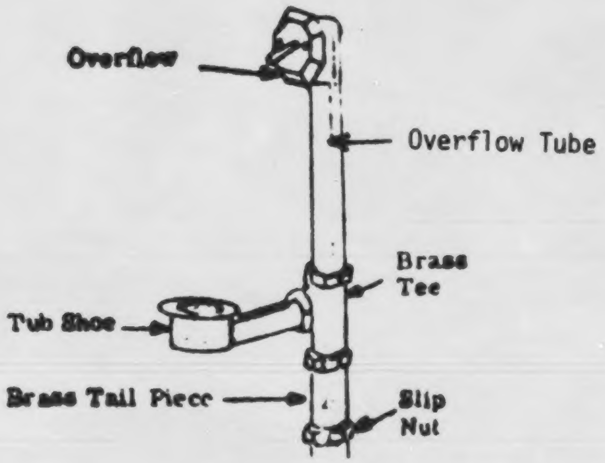
(9) Ask the instructor to check your work.

(10) Disassemble the drainage fittings and remove the tub.

(11) Clean fittings.

(12) Clean tools and return fittings and tools to storage.

FIGURE 4: WASTE AND OVERFLOW SYSTEM



2. Manufacturer's specifications and direction for installation of particular tub and shower faucets, shower head, stopper, and valves to be used. You can obtain these resources from the resource cabinet.

KEY POINT: These manufacturer's specifications and instruction sheets are available for each installed item.

PROCEDURE: continued

3. Begin the installation by obtaining the tools, equipment and supplies needed to complete the steps.

4. Following completion of the installation, have the instructor evaluate the installation.

5. If the installation is satisfactory, take the LAP test.

   If the installation is not satisfactory, proceed as directed by the instructor.

6. Score and return the LAP test.

7. If the LAP test is satisfactory, begin the next assigned LAP.

   If the LAP test is unsatisfactory, proceed as directed by the instructor.

STUDENT/INSTRUCTOR CHECK OFF LIST: BATHTUB

1. Bathtub Installation:

   Instructor's Signature________________________________

   Date________________________________

2. Roughing in the Bathtub and Shower Water Supply:

   Instructor's Signature________________________________

   Date________________________________

3. Faucet, Shower Head and Stopper Installation:

   Instructor's Signature________________________________

   Date________________________________

73.02.04.09.A2-2

Student: ______________________ **File Code:** 73.02.04.10.A2-2

Date: ______________________ **Date Published:** 12/2/74

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

LAP TEST: INSTALLING WALL HUNG LAVATORY/ INSTALLING BATHTUB

73.02.04.09

1. What size supply piping should be roughed-in for a wall-hung sink?

   a. 1 inch
   b. 1/4 inch
   c. 1/2 inch
   d. 3/4 inch

2. What size waste is usually installed on a wall-hung sink?

   a. 1-1/4 inch
   b. 1-1/2 inch
   c. 2 inches
   d. 1 inch

3. What is the on-center distance drilling for faucets on a standard drilling for faucets on a standard wall-hung sink?

   a. 12 inch O.C.
   b. 6 inch O.C.
   c. 8 inch O.C.
   d. 4 inch O.C.

4. Which of the following is the correct measurement from the finish floor for a typical wall-hung sink supply rough in dimension?

   a. 6 inches
   b. 12 inches
   c. 16 inches
   d. 21 inches

5. The bracket on a wall-hung sink must be:

   a. square.
   b. level.
   c. plumb.
   d. vertical.

73.02.04.10

6. A bathtub must have, for support reasons, which of the following on or into the outside framing?

   a. screws
   b. blocks
   c. bolts
   d. brackets

7. How long is the average bathtub?

   a. 4'0"
   b. 5'6"
   c. 5'0"
   d. 4'6"

8. When should a tub be installed?

   a. after sheetrock is installed
   b. after complete finishing of bathroom
   c. before final completion of bathroom framing
   d. after finish floor is installed

9. Before installing the bathtub, what should be done?

   a. install the faucets
   b. install the sheetrock
   c. install the finish floor
   d. cut the floor for waste installation

10. For ease of installation, when should the bathtub waste be installed?

   a. Waste installation is the last step in tub installation.
   b. After tub has been installed.
   c. Right after uncrating the tub.
   d. Before final positioning of the tub.

LAP TEST ANSWER KEY: INSTALLING WALL HUNG LAVATORY/ INSTALLING BATHTUB

LAP 09	1.	C
	2.	A
	3.	D
	4.	D
	5.	B
LAP 10	6.	B
	7.	C
	8.	C
	9.	D
	10.	D

File Code: 73.02.04.11.A2-0

Date Published: 7/17/75

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Installing Shower Cabinet

OBJECTIVES:

Install a shower cabinet at the location indicated by the construction specifications.

Install the shower cabinet using appropriate tools and procedures according to the given specifications.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Installing Free Standing Toilet" LAP test and is taken after completing that LAP.

Installation of the shower cabinet meets given specifications.

RESOURCES:

Manufacturer's specifications.

Basic tools.
Caulking irons.
Ladle.
Lead melting furnace.
Lead pot.
Shower cabinet and accessories.
Torch.

PROCEDURE:

1. Proceed to the shower stall workstation and review the manufacturer's specifications for the shower cabinet to be installed.

   NOTE: The rough-in measurements may be obtained from the description.

   It is then possible for the installer to refer to a manufacturer's rough-in book and obtain rough-in information about a particular shower cabinet prior to actually have the cabinet on hand.

Principal Author(s):

Arneson, Bundy, Frisbee

PROCEDURE: continued

2. Install the shower cabinet following the manufacturer's installation instructions.

3. When you have completed the installation, have the instructor evaluate your work.

4. When your job is approved, proceed to the next assigned LAP.

   If your job is not approved, proceed as directed by the instructor.

File Code: 73.02.04.12.A2-0

Date Published: 7/17/75

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Installing Free Standing Toilet

OBJECTIVES:

Install a free standing toilet at the location indicated by the construction specifications.

Install the toilet using appropriate tools and procedures according to the given specifications.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

The free standing toilet installation meets the given specifications.

RESOURCES:

The Know-How of Wards Simplified Plumbing, Montgomery Wards.

Basic tools.
Water closet and accessories.

PROCEDURE:

1. Read carefully the information about free standing toilet in "A Toilet" section in The Know-How of Wards Simplified Plumbing, pages 58-59.
2. Have the instructor supply the customer specification for one free-standing toilet.

FREE-STANDING TOILET DESCRIPTION #1

____

____

____

Principal Author(s):

Arneson, Bundy, Frisbee

PROCEDURE: continued

3. Go to the water closet workstation and install water closet as shown on the "Compton. Vitreous China Closet Combination" sketches that are attached to this LAP.

   This activity will require you to apply many of the skills that you have used in previous activities.

4. Have the instructor evaluate the completed installation.

   KEY POINT: During and after tank assembly it may be necessary to make ballcock adjustments.

   Use the manufacturer's installation and adjustment instructions.

5. When you have satisfactorily completed the evaluation, take the LAP test.

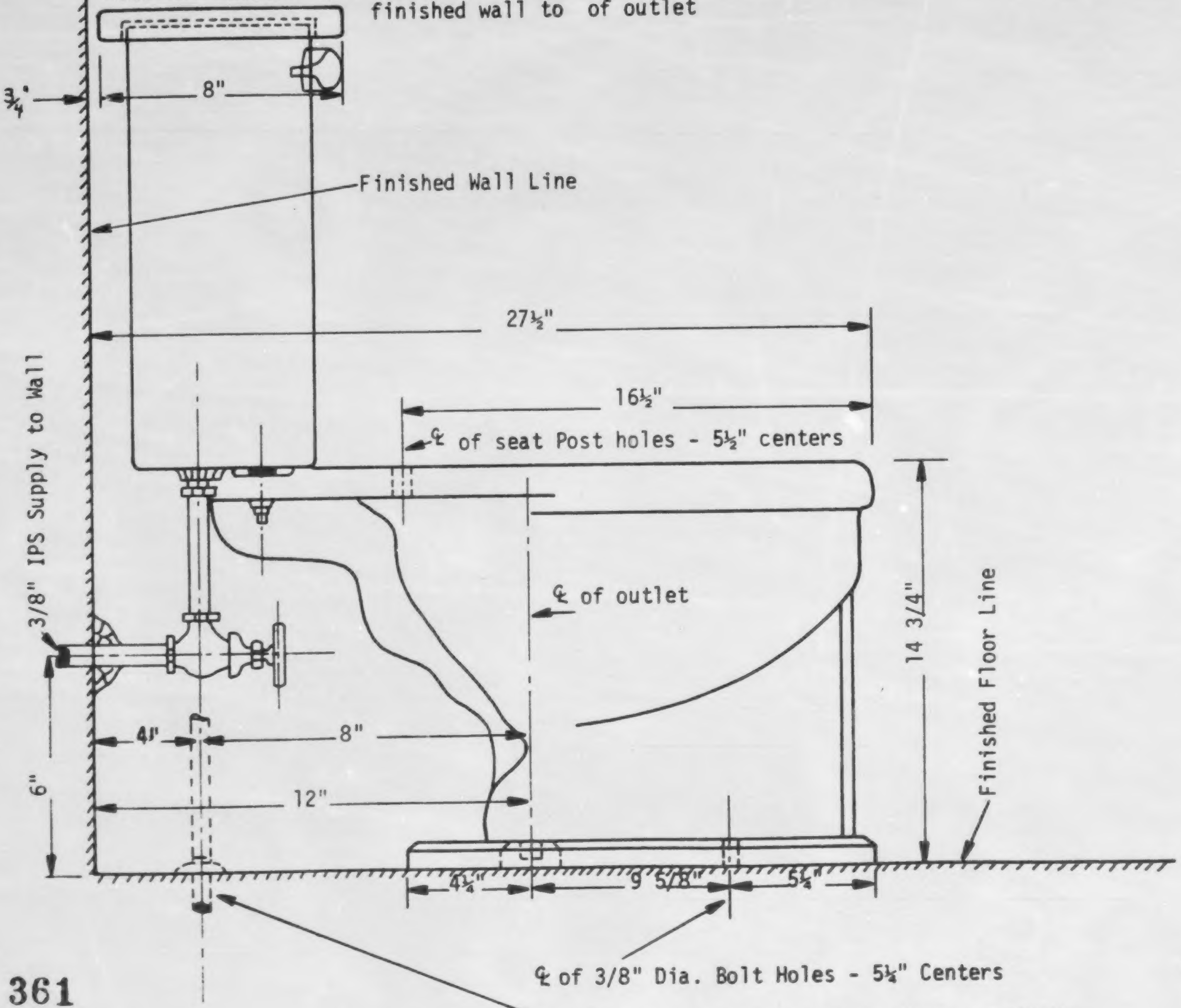
6. Score and return the LAP test.

7. If the LAP test is satisfactory, begin the next assigned LAP.

   If the test is unsatisfactory, proceed as the instructor suggests.

COMPTON. VITREOUS CHINA CLOSET COMBINATION

Note to Plumber: This closet combination is designed to Rough-In at a minimum dimension of 12" from finished wall to of outlet

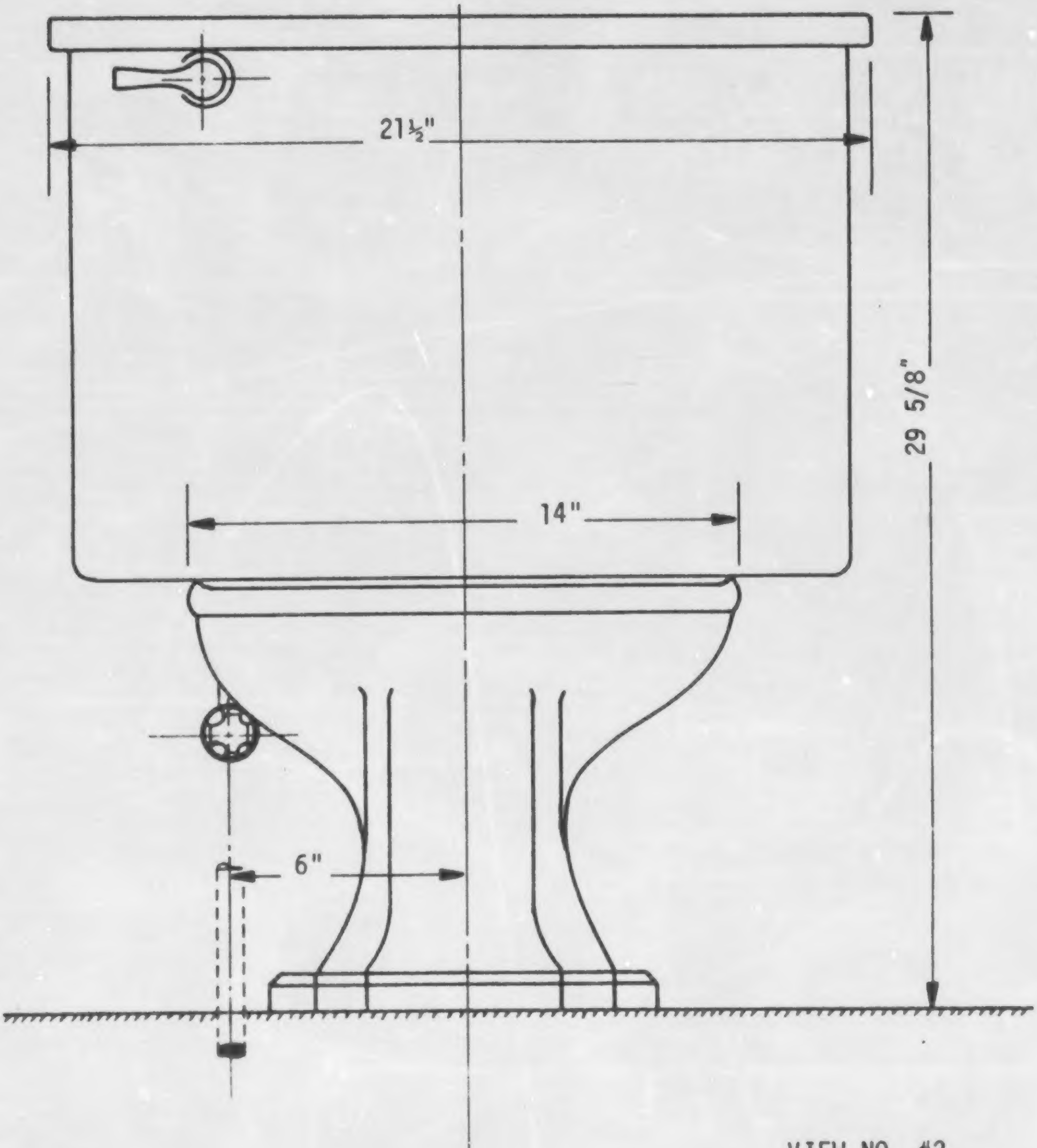

3/4"
8"
Finished Wall Line
27½"
16½"
℄ of seat Post holes - 5½" centers
3/8" IPS Supply to Wall
℄ of outlet
14 3/4"
Finished Floor Line
4"
8"
6"
12"
4¼"
9 5/8"
5¼"

℄ of 3/8" Dia. Bolt Holes - 5¼" Centers

3/8" I.P.S. Supply to floor when specified

VIEW NO. 1

COMPTON. VITREOUS CHINA CLOSET COMBINATION


21½"
14"
6"
29 5/8"

VIEW NO. #2

73.02.04.11.A2-2

Student: ______________________ **File Code:** 73.02.04.12.A2-2

Date: ______________________ **Date Published:** 12/3/74

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

LAP TEST: INSTALLING SHOWER CABINET/INSTALLING FREE STANDING TOILET

73.02.04.11

1. What is the recommended rough-in measurement for the rough nipple that is used on a shower head from the finish floor?

   a. 4'0"
   b. 5'0"
   c. 4'6"
   d. 6'0"

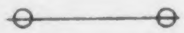
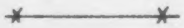
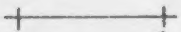
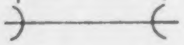
2. When installing the shower head in a shower, the head should be installed so that when a person is taking a shower the water flow is:

   a. away from the door.
   b. toward the door.
   c. direction of flow is not important.
   d. horizontal, toward the door.

3. When installing a shower base in a typical situation, what typical joint is used to connect the base to the drain?

   a. glued joint
   b. sweat joint
   c. screwed joint
   d. lead joint

4. What is the symbol for a lead joint?

   a. 
   b. 
   c. 
   d. 

5. Which of the following must be installed first when making a metal shower installation?

   a. back
   b. right side
   c. left side
   d. shower base

73.02.04.12

6. What are the roughing-in measurements for a free standing toilet water supply?

   a. 6 inches from center of toilet and 8 inches from finished floor on left side.
   b. 18 inches from center of toilet and 12 inches from finished floor.
   c. Roughing-in isn't important.
   d. 6 inches from center on right side and 10 inches from finished floor.

7. What is the most common type of closet bowl?

   a. wash down with jet
   b. common wash down
   c. siphon jet
   d. reverse trap

8. What controls the water level and input for a tank type stool?

   a. sill cock
   b. compression stop
   c. ball cock
   d. gate valve

9. How is the close coupled tank fastened to the bowl?

   a. by a brass clamp
   b. by two lag screws, the water connection sealed by putty
   c. by a special glue
   d. by two bolts, the water connection is sealed by special gasket

10. What connects a wall-hung tank to the bowl?

    a. galvanized elbow
    b. water closet elbow
    c. hose and gasket
    d. screwed pipe

LAP TEST ANSWER KEY: INSTALLING SHOWER CABINET/INSTALLING FREE STANDING TOILET

LAP 11	1.	D
	2.	A
	3.	D
	4.	D
	5.	D
LAP 12	6.	A
	7.	D
	8.	C
	9.	D
	10.	B

File Code: 73.02.04.13.A2-0

Date Published: 7/18/75

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Installing Wall Hung Toilet

OBJECTIVES:

Install a wall hung toilet at the location indicated by the construction specifications.

Install the toilet using appropriate tools and procedures according to the given specifications.

EVALUATION PROCEDURE:

Successful completed of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

The wall hung toilet installation meets the given specifications.

RESOURCES:

Blueprint Reading for Plumbers: Residential and Commercial, D'arcangelo.

The Know-How of Wards Simplified Plumbing, Montgomery Wards.

Basic tools.
Carrier.
Wall hung toilet and accessories.

PROCEDURE:

1. Review the information about a wall hung toil in "A Toilet", pages 58-59, in The Know-How of Wards Simplified Plumbing.
2. Have the instructor provide you with the customer specifications for one type of wall hung toilet.

   Model Wall Hung Water Closet to be Installed: ____________________

Principal Author(s):

Arneson, Bundy, Frisbee

PROCEDURE: continued

3. Review the manufacturer's installation instructions for the model to be installed.
4. Review "The Wall-Hung Toilet," pages 68-70, in Blueprint Reading for Plumbers: Residential and Commercial.
5. Acquire the tools, supplies and equipment you will need and complete the installation.
6. Have the finished installation evaluated.
7. When the finished installation is satisfactory, take the LAP test.
8. Score and return the LAP test.
9. If the LAP test is satisfactory, begin the next assigned LAP.

   If the LAP test is unsatisfactory, proceed as suggested by the instructor.

Student: ______________________ File Code: 73.02.04.13.A2-2

Date: ______________________ Date Published: 12/3/74

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

LAP TEST: INSTALLING WALL-HUNG TOILET

1. What kind of material is used in construction of water closets?

   a. vitreous china
   b. cast iron
   c. clay
   d. enameled steel

2. What is the name of the equipment used to attach a wall-mounted toilet to the wall?

   a. wooden bracket
   b. stool support
   c. foot
   d. chair carrier

3. How many bolts are necessary to mount a wall-hung stool?

   a. two
   b. three
   c. four
   d. six

4. What is the approximate rough-in height for the waste of a wall-hung toilet?

   a. 7 to 8 inches
   b. 2 to 3 inches
   c. 4 to 5 inches
   d. 6 to 10 inches

5. Approximately how far through finished wall should 5/8 studs project?

   a. 4 inches
   b. 1 inch
   c. 1-7/8 inches
   d. 3-3/4 inches

6. How far should outlet coupling extend through finished wall?

   a. 5/16 inch
   b. 9/16 inch
   c. 3/4 inch
   d. 1 inch

7. Why is the wall-hung toilet becoming more popular?

   a. less working parts
   b. cheaper to buy
   c. easier to install
   d. ease of cleaning around and under

8. What precaution should be used in securing bowl to wall?

   a. tighten bottom bolts only
   b. tighten top bolts only
   c. tighten bolts very tight
   d. tighten bolts evenly and snug but not too tight

9. What are the approximate water supply roughing measurements for a wall-hung toilet?

   a. 5 inches from finished floor and 6 inches from center of bowl.
   b. 10 inches from finished floor and 6 inches right from center of bowl.
   c. 4 inches from finished floor and 5 inches from center of bowl.
   d. 10 inches from finished floor and 6 inches left from center of bowl.

10. Should a wall-hung stool be hung before wall is finished?

   a. always
   b. never
   c. it depends on the blueprints
   d. it doesn't make any difference when it is hung

LAP TEST ANSWER KEY: INSTALLING WALL HUNG TOILET

1. A
2. D
3. C
4. C
5. C
6. A
7. D
8. D
9. D
10. B

File Code: 73.02.04.14.A2-0

Date Published: 7-18-75

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student:

Date:

PERFORMANCE ACTIVITY: Installing and Servicing Water Softeners

OBJECTIVES:

Connect water softeners according to manufacturer's specifications.
The connects are made using appropriate tools and procedures.
Operate and adjust the water softener to perform as specified by the manufacturer.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

Water softener operates according to given specifications.

RESOURCES:

Manufacturer's specifications and instructions.

Basic tools
Water softener and accessories.
Torch

PROCEDURE:

1. Go to the plumbing work station and install the water softener carefully following manufacturer's specifications.
2. Have the instructor evaluate the installation.
3. When the installation of the softener is satisfactory, take the LAP test.
4. Score and return the LAP test.
5. If the LAP test is satisfactory, begin the next assigned LAP. If the test is unsatisfactory, proceed as the instructor advises.

Principal Author(s): Arneson, Bundy, Frisbee

Student: ____________________ File Code: 73.02.04.14.A2-2

Date: ____________________ Date Published: 12/3/74

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

LAP TEST: INSTALLING AND SERVICING WATER SOFTENERS

1. What is the best location for a water softener?

   a. outside so you don't need a drain
   b. inside close to a drain and water supply
   c. close to hot water heater
   d. behind the furnace out of the way

2. What is the main additive to keep a water softener working properly?

   a. lime
   b. sugar
   c. gravel
   d. salt

3. What should the minimum total pipe run between a softener and a hot water tank?

   a. 8 feet
   b. 12 feet
   c. 2 feet
   d. 6 feet

4. What is the purpose of a water softener?

   a. to purify water
   b to eliminate bad tasting water
   c. to reduce certain chemical compounds making hard water domestically useable
   d. to increase the water supply

5. What is the main mineral used in water softening?

   a. zeolite
   b. coal
   c. gravel
   d. calcium

6. What fixture should be by-passed by the water softener?

   a. kitchen sink
   b. stool
   c. bathtub
   d. lavatory

7. What is the maximum water pressure for a water softener?

   a. 125 lbs PSI
   b. 200 lbs PSI
   c. 50 lbs PSI
   d. 100 lbs. PSI

8. Why should a by-pass valve be installed on a water softener?

   a. to cut installation costs
   b. to mix hard and soft water
   c. to save on soft water
   d. so water can be provided while servicing softener

9. What is the lowest room temperature at which a softener can be installed?

   a. 45 degrees
   b. 32 degrees
   c. 10 degrees
   d. zero degrees

10. After a softener is installed, what would cause a drop in water pressure?

   a. Soft water will loosen mineral deposits and clog aerators reducing pressure.
   b. Soft water doesn't need as much water pressure.
   c. Soft water doesn't compress.
   d. Softeners have minerals that reduce water pressure.

LAP TEST ANSWER KEY: INSTALLING AND SERVICING WATER SOFTENERS

1. B
2. D
3. B
4. C
5. A
6. B
7. D
8. D
9. B
10. A

Student: ____________________ **File Code:** 73.02.04.00.B2-2

Date: ____________________ **Date Published:** 11/2/74

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

UNIT POST TEST: FIXTURES

73.02.04.01

1. Which of the following joints should not be installed on the sewer side of a sink drain?

   a. screwed
   b. sweat
   c. welded
   d. slip joint

2. Which of the following joints require accurate and smooth finish machining of its surfaces?

   a. ground joint
   b. slip joint
   c. welded joint
   d. soldered joint

3. What should you do if a mistake has been made in rough-in? For example, the O.C. center on the rough-in is 8 inches and the faucet O.C. is 6 inches.

   a. obtain a different faucet
   b. remove and replace the rough-in installation
   c. use soft copper supplies
   d. use flexible supplies

4. What type of joint is used on the lower end of a supply pipe?

   a. compression joint
   b. flared joint
   c. screwed joint
   d. ground joint

5. What type of joint is illustrated in figure three that will be used to connect to faucets? (Use diagram 32, page 2.)

   a. flare joint
   b. slip joint
   c. compression joint
   d. ground joint

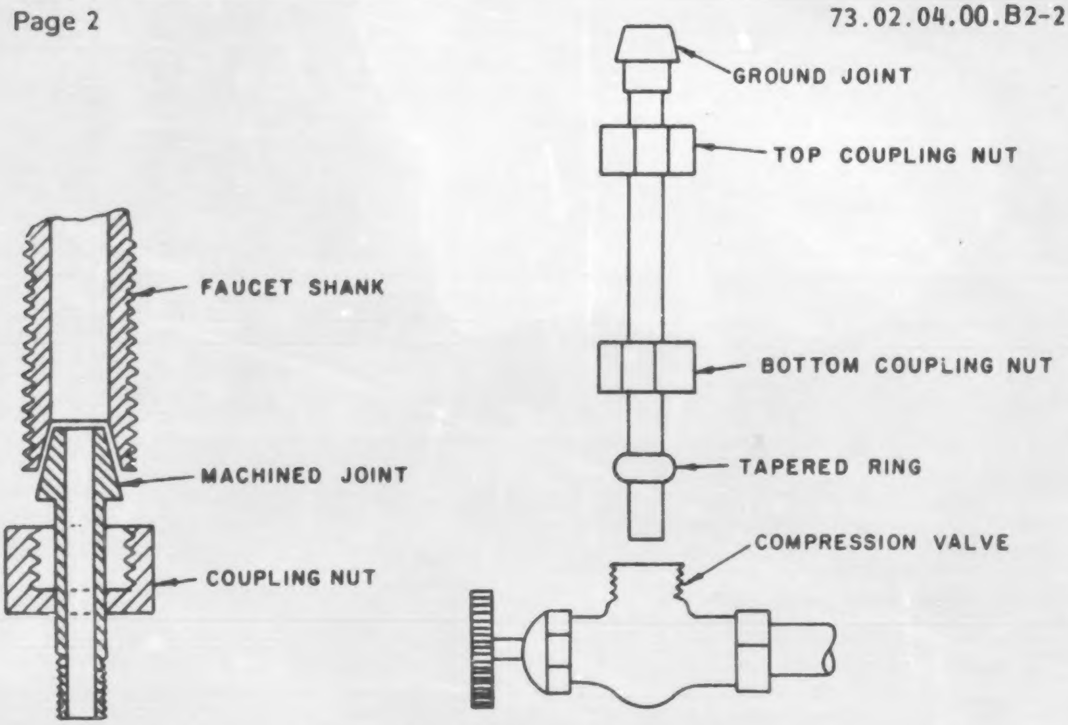
FAUCET SHANK
MACHINED JOINT
COUPLING NUT
GROUND JOINT
TOP COUPLING NUT
BOTTOM COUPLING NUT
TAPERED RING
COMPRESSION VALVE

Fig. 2

Fig. 3

Diagram 32

73.02.04.02

6. Which of the following faucets uses a spring?

   a. self-closing
   b. compression
   c. quick precision
   d. globe

7. Which of the following finishes gives the best appearance?

   a. steel
   b. polished brass
   c. polished copper
   d. chrome-plated

8. What type of faucet stem is represented in Diagram 34, Figure 1? (Use the diagram on page 3.)

   a. gate
   b. globe
   c. compression
   d. quick precision

73.02.04.02 (continued)

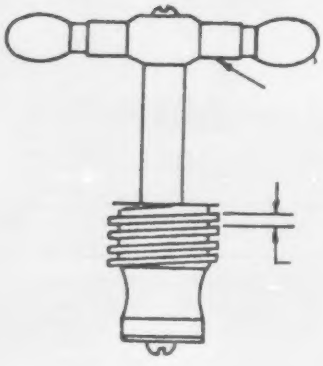

Diagram 34 Fig. 1

9. Faucets are usually constructed out of what type of material?

   a. steel
   b. copper
   c. brass
   d. zinc

10. What type of faucet stem is represented in Diagram 33, Figure 3?

   a. self-closing
   b. quick precision
   c. compression
   d. globe

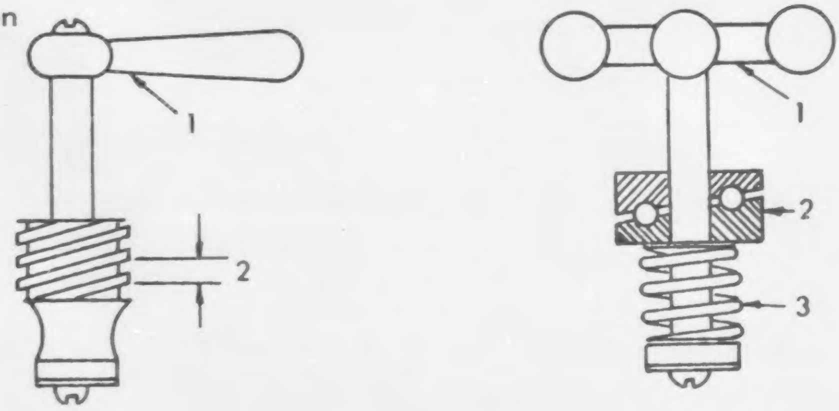

Fig. 2 Fig. 3

Diagram 33

73.02.04.03

11. Of what material is the speedway supply pipe made?

   a. brass
   b. stainless steel
   c. annealed copper
   d. chromium

73.02.04.03 (continued)

12. How are the joints in a connected waste and overflow sealed?

    a. by using solder
    b. by using a washer
    c. by using a flare joint
    d. by using grease

13. How do you connect a waste and overflow to a lead joint?

    a. use a sleeve
    b. use a compression joint
    c. thread the lead with a tap
    d. flare lead and solder

14. On a connected waste and overflow, what holds the top elbow in place?

    a. solder
    b. brass nut
    c. set screw
    d. putty

15. What is the minimum size of a bath waste?

    a. 1½ inches
    b. 1 inch
    c. 2 inches
    d. 1¼ inches

73.02.04.04

16. In the illustration of the P.O. plug, which number would correspond to the overflow? (Use the diagram on page 5, Diagram 36.)

    a. 1
    b. 3
    c. 4
    d. 2

17. In the illustration of the P.O. plug, which number would correspond to the gasket? (Use the diagram on page 5, Diagram 36.)

    a. 2
    b. 4
    c. 1
    d. 3

73.02.04.04 (continued)

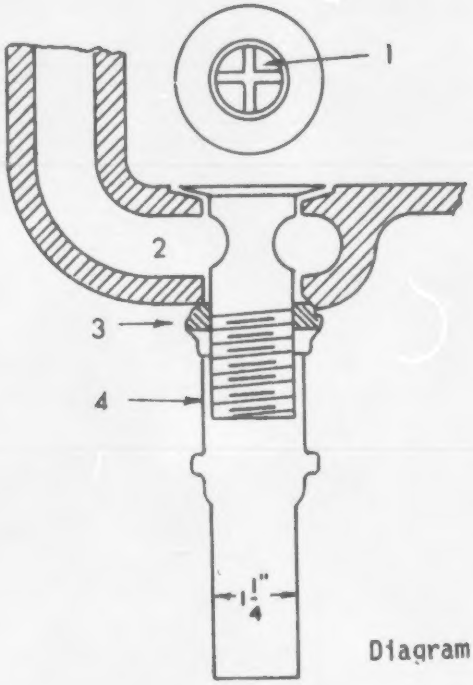

Diagram 36

18. Which of the following tools should be used to tighten the nut on a patent overflow?

    a. pipe wrench
    b. lock pliers
    c. monkey wrench
    d. water pump pliers

19. In the illustration of a strainer with a plug (Diagram 37, Figure 2), which number would correspond to the coupling nut? (Use the diagram on page 6.)

    a. 5
    b. 4
    c. 3
    d. 6

20. In the illustration of the strainer with a plug, which number would correspond to the tail pieces? (Use Diagram 37, Figure 2 on page 6.)

    a. 4
    b. 3
    c. 5
    d. 6

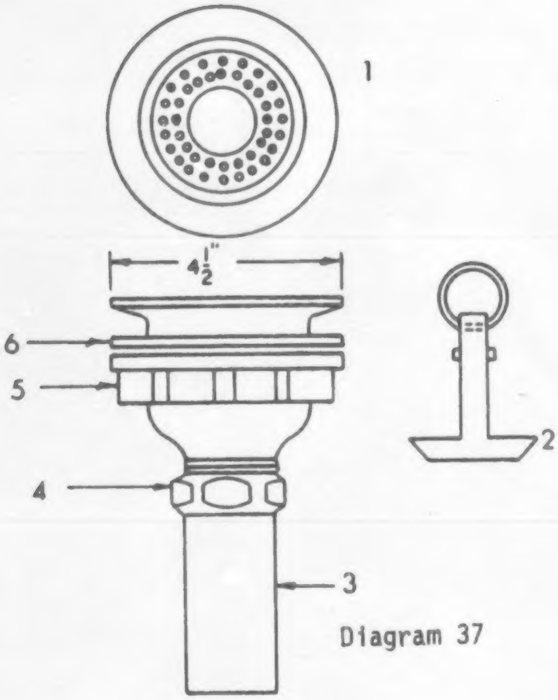

Diagram 37

73.02.04.05

21. Usually, how much lower is the mounting bracket on a wall hung sink than the top of the fixture itself?

    a. 1½ inches
    b. 3 inches
    c. 5 inches
    d. 6 inches

22. When mounting the bracket for a wall hung sink, which screw should be inserted first?

    a. it makes no difference
    b. left hand
    c. right hand
    d. center

23. Which of the following is usually the on-center spacing of studs in homes?

    a. 48 inch O.C.
    b. 20 inch O.C.
    c. 36 inch O.C.
    d. 16 inch O.C.

73.02.04.05 (continued)

24. Where would you find out what is to be the height of a particular fixture?

   a. from city engineers
   b. from home owners
   c. from blueprints
   d. from fixture specifications

25. Which of the following is an accepted height for a sink?

   a. 30 inches
   b. 36 inches
   c. 24 inches
   d. 44 inches

73.02.04.06

26. Which of the following should be applied to the counter top to waterproof the joint between the top and the sink?

   a. white glue
   b. lead
   c. oakum
   d. caulking

27. Approximately how high off a finished floor should the waste be roughed-in?

   a. 12 inches
   b. 24 inches
   c. 6 inches
   d. 18 inches

28. What size supply lines are usually run to a sink?

   a. 3/8 inch
   b. 1/2 inch
   c. 3/4 inch
   d. 1 inch

29. When should the faucets be installed in a typical sink installation?

   a. after clips have been tightened
   b. last
   c. just before turning on the water supply
   d. before sink is dropped in its opening

73.02.04.06 (continued)

30. Under what conditions would an island sink installation require a two pipe drainage system?

    a. If the run to the stock is over 8 feet away.
    b. If it is over 3 feet wide.
    c. If it has a garbage disposal.
    d. If pipe size is less than 1 inch.

73.02.04.07

31. What is the minimum size waste a garbage disposer can be connected to?

    a. 1-1/4 inches
    b. 1-1/2 inches
    c. 1 inch
    d. 1-3/4 inches

32. What type of tool should be used to turn the nuts on a slip joint used on a garbage disposer installation?

    a. pipe wrench
    b. monkey wrench or chanel locks
    c. lock pliers
    d. socket

33. If a septic tank system has a grease trap and you wish to install a garbage disposer, what should be done?

    a. Install the grinder directly in front of the trap.
    b. Do not install the grinder.
    c. By-pass the grease trap.
    d. Connect the grinder so that it operates at a higher voltage.

34. If any soldering of the waste system must be done when installing a disposer, which of the following should be installed lastly?

    a. sink sleeve
    b. snap ring
    c. mounting lug on body flange
    d. discharge tube

35. All garbage disposers must be:

    a. connected to a 208 volt system.
    b. connected to 220 volts.
    c. connected to a polyphase system.
    d. grounded.

73.02.04.08

36. What height off the floor should the pipe supplies for a vanity sink be?

    a. 21 inches
    b. 24 inches
    c. 12 inches
    d. 6 inches

37. What is the standard height for a bathroom vanity?

    a. 32 inches
    b. 36 inches
    c. 28 inches
    d. 24 inches

38. When roughing-in a vanity sink, what height off the floor should the drain pipe be installed?

    a. 18 inches
    b. 12 inches
    c. 14 inches
    d. 22 inches

39. What size waste pipe is usually installed on a vanity sink?

    a. 1-1/4 inch
    b. 1-1/2 inch
    c. 1 inch
    d. 3/4 inch

40. Which of the following fittings would be used to project a water supply system out past the finished wall when roughing-in a vanity sink?

    a. nipple
    b. 90 degree ell
    c. tee
    d. gee

73.02.04.09

41. What is the standard height of the top of a wall-hung sink?

    a. 32 inches
    b. 24 inches
    c. 28 inches
    d. 36 inches

73.02.04.09 (continued)

42. What size waste is usually installed on a wall-hung sink?

   a. 1-1/4 inch
   b. 1-1/2 inch
   c. 2 inch
   d. 1 inch

43. Which of the following is not a description of a faucet that would be used on a typical wall-hung sink?

   a. Moen single control 4 inch O.C.
   b. V/R Dual Control 4 inch O.C.
   c. Moen single lever 8 inch O.C.
   d. U/R Single Control 4 inch O.C.

44. What is the rough-in dimension from the finish floor for the waste on a wall-hung sink?

   a. 18 inches
   b. 12 inches
   c. 11 inches
   d. 6 inches

45. The bracket on a wall-hung sink must be:

   a. square.
   b. level.
   c. plumb.
   d. vertical.

73.02.04.10

46. How long is the average bathtub?

   a. 4'0"
   b. 5'6"
   c. 5'0"
   d. 4'6"

47. When should a tub be installed?

   a. after sheetrock is installed
   b. after complete finishing of bathroom
   c. before final completion of bathroom framing
   d. after finish floor is installed

73.02.04.10 (continued)

48. Approximately how much over actual tub size should the framing be?

   a. 1/2 inch
   b. none should be allowed
   c. 1-1/2 inches
   d. 2 inches

49. If you are required to install a shower-tub combination, what is the recommended height of the shower rough nipple from the finish floor?

   a. 5'0"
   b. 6'0"
   c. 4'6"
   d. 7'0"

50. If you are required to install a tub faucet, what is the recommended height of the rough nipple above the tub rim?

   a. 10 inches
   b. 4 inches
   c. 2 inches
   d. 12 inches

73.02.04.11

51. What size drain pipe is commonly used on a shower?

   a. 2 inch
   b. 1-1/4 inch
   c. 1-1/2 inch
   d. 3 inch

52. Which of the following traps should be used on most shower installations?

   a. 1-1/2 inch drum trap
   b. 2 inch S trap
   c. 2 inch P trap
   d. 1 inch S trap

53. When installing the shower head in a shower, the head should be installed so that when a person is taking a shower the water flow is:

   a. away from the door.
   b. toward the door.
   c. direction of flow is not important.
   d. horizontal, toward the door.

73.02.04.11 (continued)

54. When installing a shower base in a typical situation, what is the typical joint used to connect the base to the drain?

   a. glued joint
   b. sweat joint
   c. screwed joint
   d. lead joint

55. In most situations, when in the construction procedure should a metal cabinet be installed?

   a. before sheetrocking
   b. before framing
   c. after the sheetrock installation
   d. before insulation installation

73.02.04.12

56. What are the roughing-in measurements for a free standing toilet waste?

   a. 6 inches
   b. 12 inches
   c. 2 feet
   d. 18 inches

57. What type of gasket is generally used to set toilet?

   a. none
   b. leather gasket
   c. wax ring
   d. cement

58. As a general rule, how many types of closet bowls are there?

   a. ten
   b. four
   c. one
   d. six

59. How is a bowl generally fastened to the floor?

   a. A floor flange designed to hold two upright bolts, bowl is then set on flange and nuts applied to secure bowl.
   b. Bowl is screwed on floor flange.
   c. Bowl is held in place by wax ring.
   d. Bowl does not have to be fastened.

73.02.04.12 (continued)

60. What is the most expensive and quietest bowl?

    a. wash down with jet
    b. wash down bowl
    c. siphon jet bowl
    d. reverse trap bowl

73.02.04.13

61. What is the name of the equipment used to attach a wall-mounted toilet to the wall?

    a. wooden bracket
    b. stool support
    c. foot
    d. chair carrier

62. How many bolts are necessary to mount a wall-hung stool?

    a. two
    b. three
    c. four
    d. six

63. How far should outlet coupling extend through finished wall?

    a. 5/16 inch
    b. 9/16 inch
    c. 3/4 inch
    d. 1 inch

64. What are the approximate water supply roughing measurements for a wall-hung toilet?

    a. 5 inches from finished floor and 6 inches from center of bowl.
    b. 10 inches from finished floor and 6 inches right from center of bowl.
    c. 4 inches from finished floor and 5 inches from center of bowl.
    d. 10 inches from finished floor and 6 inches left from center of bowl.

65. Should a wall-hung stool be hung before wall is finished?

    a. always
    b. never
    c. it depends on the blueprints
    d. it doesn't make any difference when it is hung

73.02.04.14

66. What is the best location for a water softener?

    a. outside so you don't need a drain
    b. inside close to a drain and water supply
    c. close to hot water heater
    d. behind the furnace out of the way

67. What is the main additive to keep a water softener working properly?

    a. lime
    b. sugar
    c. gravel
    d. salt

68. What fixture should be by-passed by the water softener?

    a. kitchen sink
    b. stool
    c. bathtub
    d. lavatory

69. What is the lowest room temperature at which a softener can be installed?

    a. 45 degrees
    b. 32 degrees
    c. 10 degrees
    d. zero degrees

70. After a softener is installed, what would cause a drop in water pressure?

    a. Soft water will loosen mineral deposits and clog aerators reducing pressure.
    b. Soft water doesn't need as much water pressure.
    c. Soft water doesn't compress.
    d. Softeners have minerals that reduce water pressure.

UNIT TEST ANSWER SHEET

(Unit Post Test Answer Key)

Occupational Area: ______________________

File Code: 73.02.04.00 B2-2

Name: ______________________

ANSWERS

02.04.01	1.	D	73.02.04.05	21.	A	73.02.04.09	41.	A
	2.	A		22.	D		42.	A
	3.	D		23.	D		43.	C
	4.	A		24.	D		44.	A
	5.	D		25.	B		45.	B
02.04.02	6.	A	73.02.04.06	26.	D	73.02.04.10	46.	C
	7.	D		27.	D		47.	C
	8.	C		28.	B		48.	A
	9.	C		29.	D		49.	B
	10.	A		30.	C		50.	B
02.04.03	11.	C	73.02.04.07	31.	B	73.02.04.11	51.	A
	12.	B		32.	B		52.	C
	13.	D		33.	C		53.	A
	14.	C		34.	D		54.	D
	15.	A		35.	D		55.	C
02.04.04	16.	D	73.02.04.08	36.	A	73.02.04.12	56.	B
	17.	D		37.	A		57.	C
	18.	C		38.	C		58.	B
	19.	B		39.	B		59.	A
	20.	B		40.	A		60.	C

UNIT TEST ANSWER SHEET
(Unit Post Test Answer Key)

Occupational Area:
File Code: 73.02.04.00.B2-2
Name:

ANSWERS

73.02.04.13 61. D
62. C
63. A
64. D
65. B
3.02.04.14 66. B
67. D
68. B
69. B
70. A
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Student: ____________ File Code: 73.02.04.00.A1-5

Date: ____________ Date Published: 11/13/74

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Family Pay Number: ____________ Sex: M F (Circle 1)

UNIT PERFORMANCE TEST: FIXTURES

OBJECTIVE 1:

Measure, lay out and install plumbing fixtures according to specifications.

OBJECTIVE 2:

Install service traps, faucets, water connections, strainers and overflow as specified.

TASK:

The student will measure, lay out and install the fixtures. He will install two of the following fixtures which will be assigned by the instructor:

Kitchen sink - with or without garbage disposal
Stool - free standing or wall hung
Tub
Lavatory - wall hung or vanity
Shower
Laundry trays
Urinal

ASSIGNMENT:

CONDITIONS:

The student will be supplied with the necessary tools and equipment to complete the task. He may use any reference material available. No assistance will be obtained from the other students or instructors.

RESOURCES:

1. Printed materials:

   Montana State Plumbing Code
   Related information: Plumbing I and II, Harry Slater
   Audels Plumbers and Pipe Fitters library materials
   Rough-in Book for fixtures (Published by fixture manufacturers.)

2. Equipment:

   Typical hand tools (hammer, screwdriver, pliers, etc.)
   Pipe threader
   Pipe cutter
   Soil pipe cutter
   Lead Pot
   Lead Furnace
   Ladel
   Caulking irons
   Rulers, tapes, calipers
   Plastic pipe cutter
   Pipe and fittings as needed
   Fixtures
   Traps and supplies

Student: ______________________ File Code: 73.02.04.00.A1-5

Date: ______________________ Date Published: 11/13/74

Family Pay Number: __________ Sex: M F (Circle 1)

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Chooses appropriate parts, accessories, and fixtures.		
Criterion: Install according to Manufacturer's specifications.		
2. Uses appropriate tools and equipment.		
Criterion: a. Hand Tools, Westinghouse Learning Corp.		
b. No damage to fixtures or parts.		
3. Measurements are accurate.		
Criterion: Manufacturer's specifications.		
4. Fixtures are properly assembled.		
Criterion: Functions to manufacturer's specifications.		
5. Fixtures are properly positioned and fastened.		
Criterion: a. State Plumbing Code.		
b. Building Codes.		
c. Manufacturer's specifications.		
6. Fixtures will be installed in a neat manner being plumb,		

(Checklist continued)

	CRITERION	
	Met	Not Met
level and square.		
Criterion: ± 1/16"		
Objective 2:		
7. Water lines are properly connected.		
Criterion: No leaks.		
8. Trap is properly connected from fixture to waste line.		
Criterion: a. No leaks.		
b. State Plumbing Code.		
9. Complete in a reasonable amount of time.		
Criterion: 8 hours.		
The student must complete 8/9 line items satisfactorily to pass the test.		